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comprehensive area-wide water and sewer plan

1970

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December 12, 1970

Department of Planning and Economic Development
State of Montana
Capitol Post Office
Helena, Montana 59601

Gentlemen:

In accordance with our agreement for water and sewer planning for forty nine of the fifty six counties in Montana, we hereby submit this Comprehensive Area-Wide Water and Sewer Plan.

This report is based on engineering and planning studies made throughout the county areas. The population characteristics and trends, the economics, and the natural resources of the counties were carefully analyzed. Based on information gathered from the study and on examination of existing water and sewer facilities, recommendations for new or improved water and sewer facilities were made where applicable.

We wish to express our appreciation for the cooperation we have received from the federal and state agencies we have worked with and from the administrative agencies, the community and civic leaders, and the residents of the counties involved.

Respectfully submitted,

Jack F. Mueller

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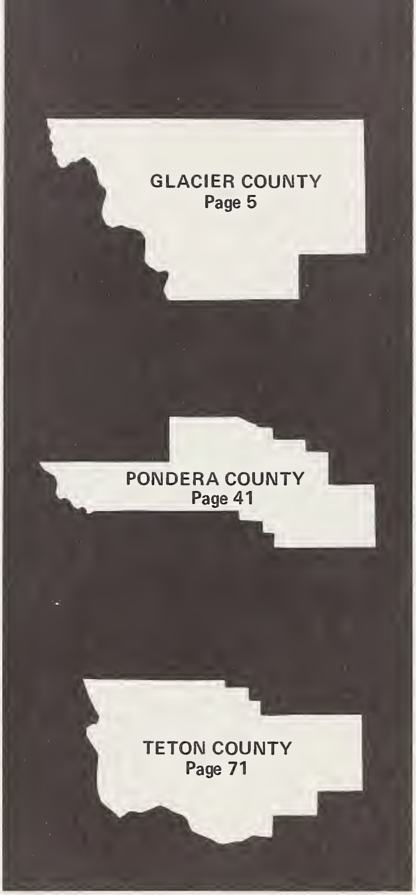
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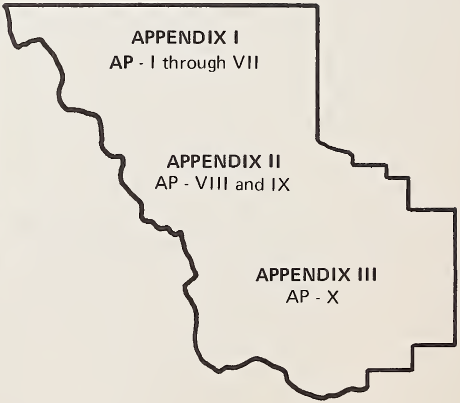
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GLACIER COUNTY

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INTRODUCTION

The State of Montana is basically rural in nature with the vast majority of its people still living in small rural communities and there is every indication this situation will continue for many years. It is important, therefore, to provide adequate and suitable water and sewer facilities for this rural population. The need is just as important as for the larger urban areas, but the problems of rural communities are often overlooked in our rapidly urbanizing society.

This Comprehensive Water and Sewer Study analyzes the present state of water supply and sewage disposal and is based on projected changes in population, economy, and land use. It projects improvements and additions required to meet needs during the next twenty years. Although the report is technical in nature, every effort has been taken to make it understandable to any interested person while retaining those details required for persons responsible for engineering these facilities. Adequate water and sewer facilities can be provided only with the active support of an informed and concerned citizenry.

While the general purpose of this study is to provide information necessary for coordinated planning of water and sewer facilities on a county wide basis, the specific aims of the study are to:

1. Develop an awareness on the part of the people of rural areas as to their water and sewer problems and needs.
2. Provide the information necessary for a concerned citizenry to be properly informed on water and sewer problems and needs.
3. Develop on the part of the people affected a desire to solve or prevent problems in connection with water and waste disposal.
4. Suggest the best and alternative sources of water and methods of waste disposal.
5. Prevent unnecessary duplication and underdesign or overdesign of water and sewer facilities.
6. Coordinate use of common facilities such as water supplies and waste treatment plants.

This plan encompasses all rural communities within the county containing five or more dwelling units but having a population of less than 5,500. The requirements of the Farmers Home Administration, which funded the project, and the Montana Department of Planning and Economic Development concerning water and sewer plans are satisfied by this study.

CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

CONCLUSIONS

Glacier County is expected to show steady population growth throughout the planning period. The population increase is expected to take place throughout the county in general, not in any particular location. Practically all communities will experience some population increase.

The existing community water and sewer systems need some expansion and improvement in order that adequate and safe systems can be made available to as many residents as possible. Generally, those persons residing within the corporate boundaries of the cities have access to the community system, but the developments adjacent to these boundaries do not. Several of the smaller towns do not have community sewer or water systems at this time; however, systems are feasible and could be constructed.

It is the intent of this plan to show that existing facilities can be expanded to new areas and to show where enlargement of these facilities may be necessary to accomplish this. Layouts for new systems have been proposed where population is expected to increase or where sufficient demand now exists to make these systems feasible.

RECOMMENDATIONS

This plan shows the various types of improvements which the communities should be considering during the planning period. The system proposals are not elaborate and represent the basic facilities necessary to provide safe and adequate community systems. It is recommended that the general proposal of this plan be adopted by the various governing agencies of each community. A detailed approach, to be followed in accomplishing the results which are to be achieved in each community, cannot be covered in a report of this type. Community leaders do have, however, several courses of action which may be taken.

It is realized that most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to construct such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P. O. Box 850
Bozeman, Montana 59715

Federal Water Pollution Control Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health,
Education and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and
Urban Development
Assistant Regional Administrator
Region VI Northwest Area Office
197 New Custom House
721 19th Street
Denver, Colorado 80202

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action will be most beneficial to them.

PRIORITIES

It is difficult to establish that a particular system requires immediate improvements or that another system will be satisfactory for a definite period. Several indicators for establishing priorities are available. The general health of the people is certainly the prime consideration and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Wastewater must be treated and disposed of by safe methods to minimize the problem of pollution and to protect public health. The total number of persons benefited by any improvement must also be considered. These are the basic criteria used in establishing the following priority listing:

1. **Cut Bank Water System.** The total population benefiting from this improvement makes this project very important. A water shortage exists and the proposed improvements should be constructed to alleviate the problem.

2. **Browning Sewer System.** Lack of a satisfactory outfall line and adequate treatment facilities make this project very necessary. The total number of persons benefiting from the improvement and the elimination of a pollution problem are the primary factors to consider.

3. **East Glacier Water System.** The present water system for the area west of the railroad is considered to be inadequate for their needs. The number of persons benefiting by an improvement in this facility and the elimination of an undesirable situation make this project very necessary.

4. **East Glacier Sewer System.** The present sewage treatment facilities are considered to be inadequate and it is very important that new facilities be constructed. Also, the area west of the railroad does not have a suitable sewer system. The elimination of a pollution problem and providing adequate facilities to all the residents are considered to be of prime importance.

5. **Browning Water System.** The number of persons who would benefit from the improved water service make this project very important.

6. **Cut Bank Sewer System.** Present sewage treatment facilities are considered to be inadequate and it is necessary to expand these facilities as proposed.

7. **Santa Rita Water System.** Lack of an adequate and safe water system make this project very necessary.

8. **Santa Rita Sewer System.** The number of persons who would benefit from this improvement make the project feasible.

9. **Babb Water System.** There is presently sufficient population to justify the construction of a community water system capable of serving all the residents.

10. **St. Mary Water System.** The number of permanent residents and the substantially increased summer population make the construction of a central water system feasible and necessary.

11. **St. Mary Sewer System.** The permanent population and the substantially increased summer population are sufficient to justify the construction of a safe and adequate sewer system.

12. **Babb Sewer System.** The number of residents which would benefit by this improvement make the project feasible.

It is not intended that this list of priorities govern the order in which action be taken. The order is merely intended to rank the severity of the problems and need for improvements.

THE LAND

GENERAL CHARACTERISTICS

Glacier County, located in the extreme northern part of the State of Montana, borders the Canadian Province of Alberta and is bounded within the state by the counties of Flathead, Pondera, and Toole on the west, south, and east sides respectively. The total land area of the county is 3,006 square miles of which only thirty two square miles represent water surface area. Duck Lake, Lake Sherburne, and St. Mary Lake in the northwestern part of the county account for the majority of the water surface area.

As seen on Map 1, the topography of Glacier County is characterized by land that changes from rolling plains in the eastern portion to high rugged mountains that form part of the Continental Divide in the western part of the county. Elevations vary from 10,448 foot-high Mount Cleveland in the northwestern part of the county to elevations as low as 3,300 in the east end of the county where the Marias River flows into Pondera County. Although the largest community in Glacier County, Cut Bank, is located in the eastern portion of the county, population has spread more or less evenly throughout the area.

Glacier County is served by two federal highways and a network of state and county secondary roads. U. S. Highway 2 runs west from Shelby in Toole County through Cut Bank, Browning and East Glacier and on into Flathead County to the west. U. S. Highway 89, traversing the county in a southeast to northwest direction, serves the communities of Browning, Kiowa, St. Mary, and Babb.

Rail transportation is provided by a main line of the Burlington-Northern Railroad which runs roughly parallel to U. S. Highway 2. Besides daily freight trains that serve the area, the Empire Builder and Western Star passenger trains provide service to Cut Bank.

The liquid freight transportation service provided by the railroad is of particular importance to the crude oil and natural gas industry of the area.

Although there are no commercial airports in the county, daily air services and connections to nation wide airlines are available at Great Falls and Havre. Cut Bank does, however, have a good paved airport facility which provides aircraft services. Unpaved aircraft landing fields, located at Babb and Star School, are also available for public use.

The Glacier Electric Cooperative, Inc. provides power service to Glacier County. Headquartered in Cut Bank, this electric cooperative purchases its power from the United States Bureau of Reclamation which distributes power for Glacier County in Havre. The Bureau of Reclamation is part of the Northwest Power Pool, thus making the possibility of a power failure in the Glacier County area quite remote.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

Telephone service is provided by two telephone companies and one telephone cooperative. The Mountain States Telephone Company provides service to the Cut Bank, St. Mary, and East Glacier areas. The Browning Telephone Company serves Browning and the rural area comprising the middle one third of the county. With the exception of Cut Bank, the Northern Telephone Cooperative serves the eastern one third of the county.

LAND OWNERSHIP AND USE

As can be seen on Chart 1, there are three main types of landowners in Glacier County. The largest segment of land, seventy percent, consists of the Blackfeet Indian Reservation. Twenty one percent of the land is federal and consists of 25,304 acres of the Lewis and Clark National Forest and 369,677 acres of Glacier National Park. The remaining nine percent of the county is privately owned.

Land use in the county is reflected by the general physical characteristics of the area. Over three fourths of the land is used for agricultural purposes with the largest share of the remaining area, twenty one percent, consisting of the forested areas in the western part of the county. Only one percent consists of water surface area. Land used for townsites, transportation, and similar purposes are included in the above general categories.

NATURAL RESOURCES

One of the most important natural resources of Glacier County is petroleum. Cut Bank Field, discovered in 1932, has 729 producing wells and is the largest oil field in the county. Located, as are the rest of the petroleum fields, in the eastern half of the county, Cut Bank Field produced 3,673,177 barrels of petroleum in 1968 and averaged 10,036 barrels daily. Another Cut Bank Field was discovered in 1945.

These two fields along with Reagan Field (discovered 1947), Blackfeet Field (discovered 1955), Red Creek Field (discovered 1958) and Graben Coulee Field (discovered 1961) are the major oil fields in the county. The Union Oil Company of California operates a petroleum refining and absorption plant east of Cut Bank. This plant processes four thousand barrels a day and produces such products as premium and regular gasoline, white gasoline, jet fuels, stove oil, and diesel fuels.

Cut Bank Field is also the largest natural gas field in Montana and produces much of the natural gas used by Montanans. The gas producing areas of Cut Bank Field and adjoining Reagan Field, which overlap into Toole County, produced 7,811,914 M.C.F. (thousand cubic feet) of natural gas in 1968.

The future of the oil and gas industry in Glacier County promises to be bright and, in all probability, the area will continue as an important oil and gas producing center.

There are several deposits of bituminous coal in Glacier County located on the Blackfeet Indian Reservation. Although this coal reserve is estimated at between thirty and fifty million tons, it is not economically feasible at the present time to mine the coal. In the future, however, these coal supplies do have potential value as fuel for a steam-electric generating plant in the area.

The existing iron deposits in the county are, again, not economically feasible to mine at the present time. Changes in future economic conditions may, however, alter this situation.

Sand and gravel are part of the mineral resource picture of Glacier County and are fairly widespread in the southern portions of the county.

There are approximately 120,000 acres of commercial forest in Glacier County; however, more than ninety percent of this forest is on national park or forest lands and protected from commercial use. The small amount of timber that was cut yielded only $325.00 to the county in 1969.

Recreational opportunities in Glacier County are greatly enhanced by the existence within its borders of a large part of Glacier National Park. Recreation varies from over one thousand miles of wilderness trails to golf courses. Part of Lewis and Clark National Forest is also within the county and offers, like Glacier National Park, a multitude of outdoor activities.

The several lakes and many streams in the county offer a wide variety of fishing opportunities. Duck Lake, in the St. Mary River drainage, is an exceptionally fine lake for record size rainbow trout. Cut Bank Creek, especially that portion upstream from Cut Bank, is another exceptional fishing area offering fine brown and rainbow trout.

Most big game hunting in Glacier County is restricted to the whitetail and mule deer and the antelope of the eastern areas. Due to the public park and forest lands in the western areas, hunting is prohibited except for a small area in the extreme southwestern part of the county; here limited numbers of deer, elk, mountain goat, and bear may be hunted.

SOILS

The soils of Glacier County were greatly affected by the glaciers of the Ice Age from which the county gets its name. The specific effects of these glaciers on the soils and their detailed description are covered in detail later in this report.

Generally, the soils of the middle and eastern portions of the county are of the agricultural supporting type. The climate of the county tends to limit the uses of the soils, and most of the higher elevation bench areas are limited to grasslands. Some of the lower elevations, such as that of the Seville Bench area west of Cut Bank, are extensively irrigated and produce high crop yields. The soils in the western parts of the county are alpine and support mostly forest and some grassland areas with some of the soil too stony to support any life at all.

WATER

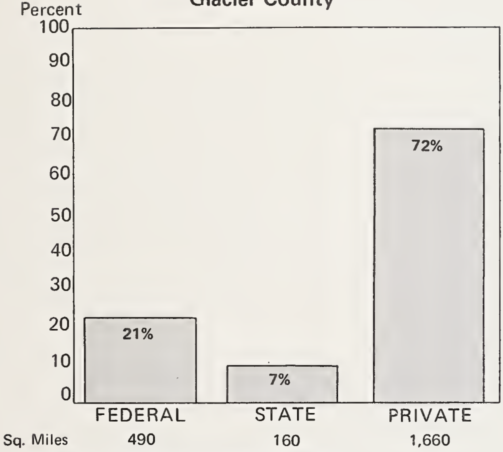
A unique characteristic of Glacier County is that it is the only county in the United States which has drainage into three oceans. Water runoff from Triple Peak in Glacier National Park flows into the Atlantic, Arctic, and Pacific Oceans. Most of the streams in the county, however, eventually empty into the Gulf of Mexico via the Missouri and Mississippi Rivers. The St. Mary River, another major drainage system, drains north into Canada's Hudson Bay. The Milk River and Cut Bank Creek join near the southeastern corner of the county into the Marias River and complete the major drainage features of the area.

Water resources are covered in more detail later in this report.

CHART 1

LAND OWNERSHIP

Glacier County

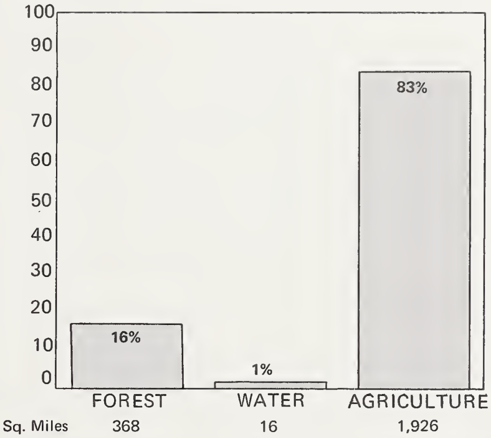


Source: The Montana Almanac 1959-60

CHART 2

LAND USE

Glacier County



THE PEOPLE

POPULATION

For analytical and projective purposes, it is useful to study the population history of Glacier County to find out what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that of the State of Montana and indicates the future growth for both.

For the twenty year period of 1920 to 1940, Glacier County experienced a sharp population increase. The rate of growth far exceeded that recorded for Montana as a whole. Since that time, the growth rate for the county has approximated that for the state and will continue to run a similar course throughout the planning period.

The United States Bureau of the Census has classified Glacier County as a semi rural area containing at least one incorporated community of 2,500 or more persons. Table 1 indicates that since 1950 both the urban and the rural populations have grown at a similar rate of over ten percent for each decade. During the same period, the farm population experienced a substantial decrease of twenty four percent for each ten year period.

The county increased its population 1,920 during the period of 1950 to 1960. Chart 4 indicates that, of the recorded change, there was a net migration loss of 759 persons and a 2,679 population gain resulting from the excess of births over deaths.

The change in sex composition for Glacier County from 1950 to 1960 is shown in Chart 5. As indicated, the percent of total population has remained the same for both sexes over the two reporting dates. If current trends take place in Glacier County, as experienced in other Montana counties, it is expected that in the future there will be a slight preponderance of females over males. The age distribution by sex for 1950 and 1960 are shown in Table 2. The largest population is recorded for those groups under thirty five, but a gain is also noted for all age groups.

A total of seven towns and communities have been studied for Glacier County. The list includes the two incorporated towns of Browning and Cut Bank and the unincorporated communities of Babb, Blackfoot, East Glacier, Santa Rita, and St. Mary. The community of Star School was also studied but was found to be a self contained complex with all sewer and water needs supplied by the Bureau of Indian Affairs.

Because of the time passed since the 1960 Census, current population estimates had to be derived from several sources in the field. Surveys and interviews have been undertaken to determine what now exists and what is expected in the future. Table 3 indicates the past population experience and the future growths for the communities.

Over the next twenty years, Cut Bank will continue to serve as the major urban center for Glacier County. The petroleum and related industries have continued to add to the importance of the town and will cause it to grow in the future as shown in Table 3. Table 3 also indicates the growth for the fringe area. It is expected that the southerly portions of the town will attract the future growth; other growth will also occur north on State Secondary Highway 213.

The town of Browning will also grow and remain an important urban center in Glacier County. Some growth has been realized around the fringes of the community and it is anticipated these areas will continue to grow. The growth of Browning will be north in the vicinity of the Bureau of Indian Affairs complex and in the southerly portions of the town.

The communities of Babb and East Glacier will experience some growth during the twenty year planning period. The growth of Babb will be within the existing area of the community and East Glacier will develop westerly of State Secondary Highway 49. St. Mary will also realize a minimal growth during the same period. Both East Glacier and St. Mary are affected by an increased population during the summer months. The communities of Blackfoot and Santa Rita will lose population by 1990.

It should be emphasized that the population figures reflect only those factors and trends for which there is available information. New technological advances, new industries or other unforeseen actions may alter the population forecasts given. In case of such an event, the areas affected should be re-examined in light of the new condition.

HOUSING

In 1960 there were 3,471 housing units within Glacier County. Chart 6 indicates that there were almost as many urban homes as there were rural non farm and that only a small percent were represented by farms. The median housing unit size was 4.0 rooms per unit and the median household size per occupied unit was 3.78 persons. Of those units, approximately half were owner occupied while one out of every three was used for rental purposes. Chart 7 indicates that a substantial fourteen percent were vacant. The condition of housing in 1960 is reflected in Chart 8 which indicates that eleven percent were in need of replacement while one home in five needed repairs. The remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of the source of water, water supply and the method of sewage disposal. For geographical reference, the data shows the status for Glacier County, the urban areas, the farms and the rural non farm dwelling units.

In 1960 approximately two out of every three homes in Glacier County were served by a public water system or by a private company. Those served included almost all homes in urban areas, less than half of the rural non farm units and only one out of twenty farms. Only one fifth of the homes in the county obtained water from individual wells while two out of three farms utilized that source. One home out of five in the county used sources other than a public water system or individual wells for their supply of water. That figure included one third of all rural non farm units as well as one third of all farms in the county.

The majority of all homes in Glacier County enjoyed inside piped water in 1960. The rural non farm areas had thirty seven percent of the homes without any piped water while one third of all farms lacked the same convenience. One home in five in the county lacked piped water in 1960.

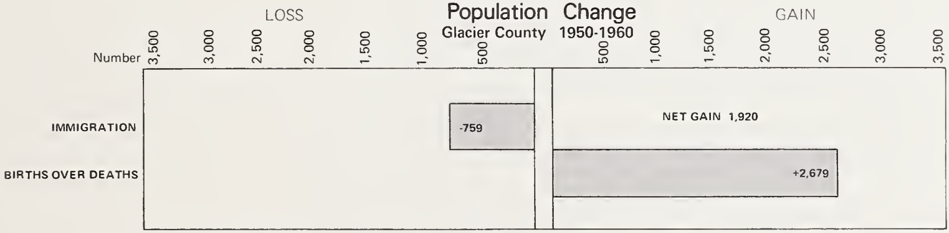
Sewage disposal in 1960 was mainly handled by a public sewer system. Sixty percent of all homes in the county were connected to such a system which included almost all homes in the urban areas as well as more than one third of those of the rural non farm type. Just over half of all farms used either a septic tank or cesspool for sewage disposal, while the remaining farms utilized some other method.

In terms of source of water, water supply and sewage disposal, the rural non farm areas were behind the other areas in 1960. If the quality of living conditions in that area is to equal those of the urban areas, attention needs to be directed towards upgrading their deficiencies more so than those existing elsewhere in Glacier County.

CHART 4

Population Change

Glacier County 1950-1960

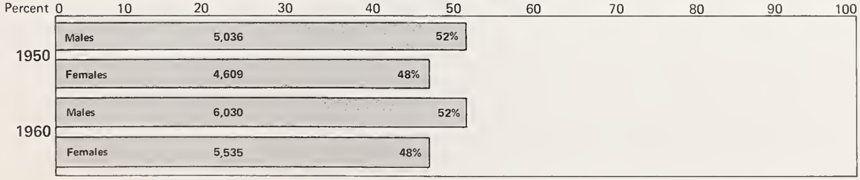


Sources: 1. Net Migration of Population, 1950-60 by Age, Sex and Color
2. U. S. Department of Agriculture

CHART 5

Population by Sex

Glacier County 1950-1960

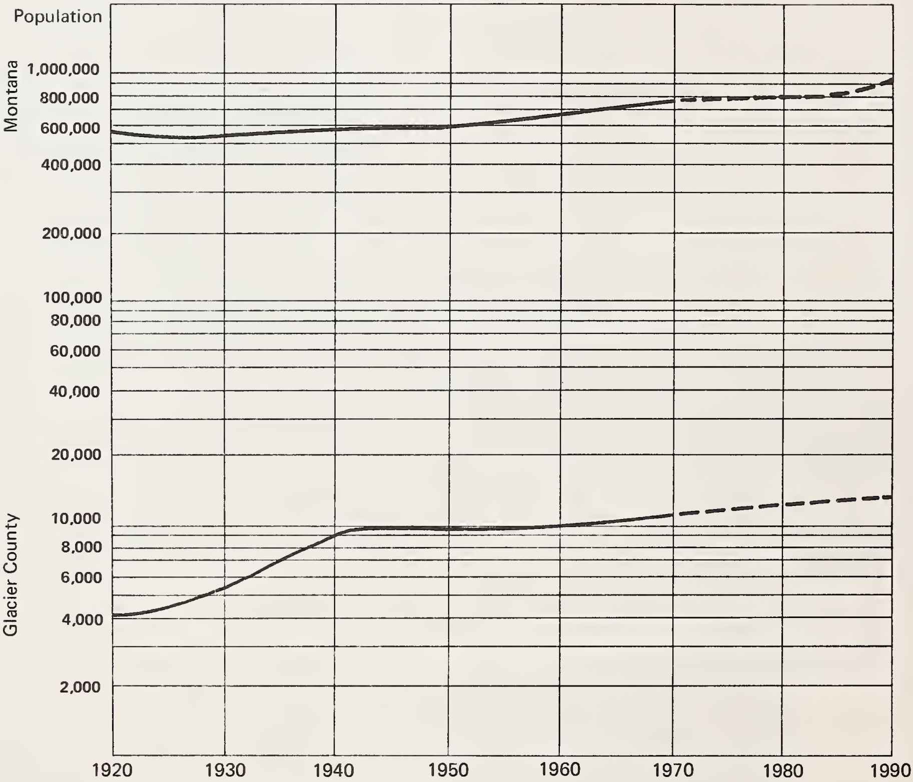


Source: U. S. Census of Population

CHART 3

Comparative Population Trends

Glacier County and Montana 1920-1990



Sources: 1. U. S. Census of Population
2. Intermountain Planners, Inc.

TABLE 1
Urban-Rural Population Changes for Glacier County
1950-1970

	1950	1960	Changes Number	1950-1960 Percent	1960	1970	Changes Number	1960-1970 Percent
Total	9,645	11,565	+1,920	+19.9	11,565	12,000	+435	+ 3.8
Urban (Inc. Towns)	5,412	6,550	+1,138	+21.0	6,550	6,800	+250	+ 3.8
Rural	4,255	5,015	+ 782	+18.5	5,015	5,200	+185	+ 3.7
Farm	1,986	1,430	- 556	- 28.0	1,430	1,150	- 280	- 19.6
Non Farm	2,247	3,585	+1,338	+59.5	3,585	4,050	+465	+13.0

Sources: 1. U. S. Census of Population
2. Intermountain Planners, Inc.

TABLE 2
Age & Sex Composition of Glacier County

	1950		1960	
Age Group	Male	Female	Male	Female
Under 5	616	627	902	878
5-14	1,025	1,021	1,365	1,326
15-19	342	362	481	421
20-24	322	346	372	367
25-34	728	717	785	720
35-44	676	611	693	641
45-54	594	437	604	538
55-64	426	254	455	330
65-74	225	164	243	196
75 +	82	70	130	118
Total	5,036	4,609	6,030	5,535

Source: U.S. Census of Population

TABLE 3
Population Forecast for Towns and Communities
Glacier County

	1950	1960	1970	1975	1980	1990
Browning	1,691	2,011	2,200	2,300	2,320	2,600
Fringe	NA*	NA*	370	400	430	475
Cut Bank	3,721	4,539	4,600	4,630	4,650	4,700
Fringe	NA*	NA*	150	160	170	175
Babb	25	50	57	61	65	69
Blackfoot	25	80	50	45	43	40
East Glacier	325	400	410	420	450	500
Santa Rita	140	150	125	115	100	90
St. Mary	NA*	NA*	35	40	47	50

Sources: 1. U.S. Census of Population
2. Intermountain Planners, Inc.

* Not Available

Housing

Glacier County 1960

CHART 6

Housing Classification

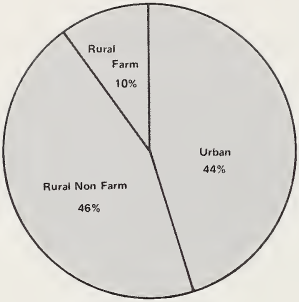


CHART 7

Housing Tenure

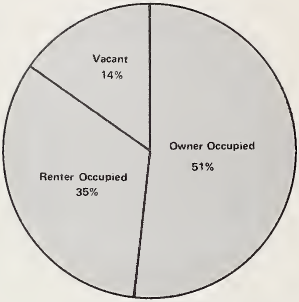
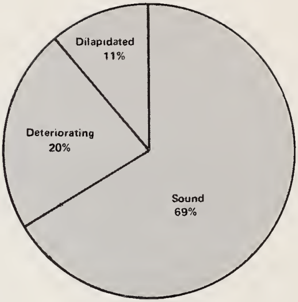


CHART 8

Housing Condition

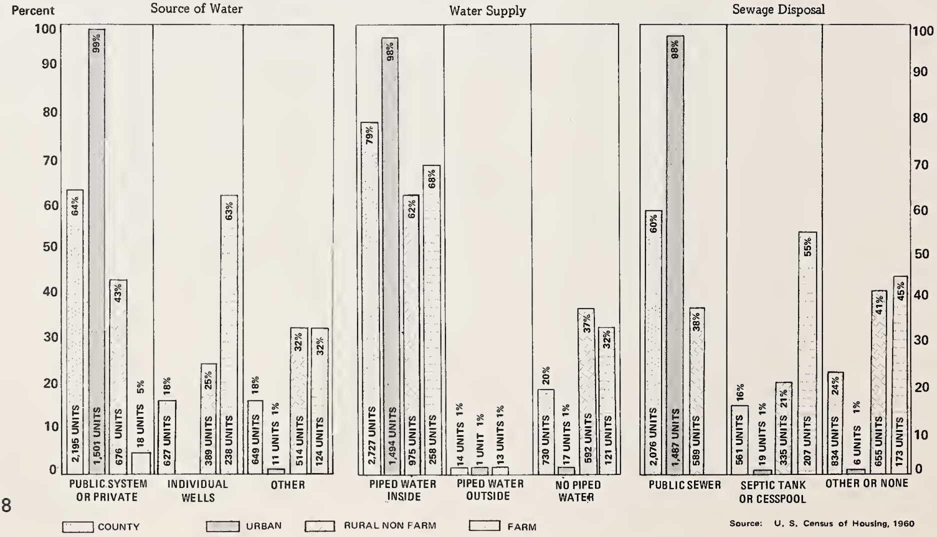


Source: United States Census of Housing, 1960

CHART 9

Water and Sewer

Glacier County 1960



Source: U. S. Census of Housing, 1960

THE ECONOMY

LABOR

People are important to the economy of Glacier County because they are both producers and consumers of goods and services. The following analysis is concerned primarily with the total economic spectrum and how it may affect the future of Glacier County. Changing economic conditions can have either a good or a bad effect on an area in terms of population growth, ability to provide for public improvements or in determining the general overall living environment.

The employment of the county followed state trends for the period of 1950 to 1960. Both units experienced an employment growth of six percent.

The past employment change by major industry group is shown in Chart 10. The most significant change over the ten year period is noted in the services and finance segment which grew by forty percent and represents the major employment group in the county. This group includes such people as barbers, insurance men, bankers, beauticians, and others who provide service to the persons actually producing the goods.

The trade group is the second largest employment segment in the economy of Glacier County. It recorded a fifteen percent increase in employment over the ten year period. It appears that the main consumers of the trade and the services and finance groups are those persons engaged in the mineral fuel industry. A county profile study by the Office of Economic Opportunity indicates that in 1964 over fifteen percent of all employment were connected with the gas and oil industry. At the same time, that group represented over one fifth of the payroll in the county.

The percentages for employment by industry group, as shown in Table 4, provide an insight into the employment characteristics of Glacier County. The table shows the relative weight of each industry group in the county and offers a comparison with that existing in 1960 for the State of Montana and for the United States.

The relative importance of mining to the economy is indicated by having a rate more than twice that of the state and seven times that of the nation. There are several coal and iron deposits in the county, mostly located on the Blackfeet Indian Reservation.

Agriculture is a major contributor to the local economy and represents almost twenty percent of the employment in the county. This industrial group will be covered in greater detail in the next section.

The available labor statistics for 1969 indicate a general lowering of the total number of workers employed in each industry group; however, agriculture and mining will continue to remain the most stable with reductions of varying degrees noted in the other major groups.

It appears that agriculture, the oil and gas industry and the supporting industries for each will provide the greatest potential for expansion of the economy in the future. Cut Bank is one of the largest oil field material and supply centers in Montana. The largest single industrial installation in the area is the refinery and absorption plant of the Union Oil Company of California which has a crude capacity of approximately four thousand barrels per calendar day.

AGRICULTURE

A farm is defined by the United States Census Bureau as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually.

According to Chart 11, there were 404 farms in Glacier County in the above category in 1964 or four percent more than there were in 1959.

Of the total number of farms, thirty seven were classified as part time and seventeen were classified as being operated by semi retired persons.

Farms in Glacier County are generally large and about half produce primarily grain crops while the other half is engaged in livestock production. In 1964 the average farm size was 3,938 acres. Chart 12 indicates that almost three out of every four farms exceeded one thousand acres in size. At the same time, only one farm in five was under five hundred acres.

The 1964 classification of farms by type in the county was as follows:

Field crop farms other than vegetables, nuts and fruit		166
Cash grain	166	
Poultry farms		3
Livestock farms other than poultry and dairy		165
General farms		9
Miscellaneous and unclassified		61
Total		404

The value of products sold, by the number of farms, further indicates the size of the agricultural operations in the county. As seen in Chart 13, over half of all farms reported sales in excess of $10,000 in 1964 while almost one third of all farms noted sales of over $20,000.

The following cash receipts data for Glacier County from 1964 to 1967 gives an indication of the importance agriculture plays in the economic picture.

Year	Livestock	Crops	Total
1964	$2,266,300	$3,607,200	$5,873,500
1965	$3,175,700	$4,607,100	$7,782,800
1966	$3,608,800	$5,433,900	$9,042,700
1967	$3,705,200	$4,293,200	$7,998,400

In 1964 the sale of crops amounted to about sixty percent of the total value of all products sold in the county. Throughout the four year period, the ratio of crop sales over livestock remained the same.

The future outlook for agriculture in Glacier County is to continue as it has in the past; there will be, however, a gradual reduction in the number of farms as national trends continue to be followed.

TABLE 4
Percent of Total Employment by Industry Groups Glacier County, Montana and United States 1960

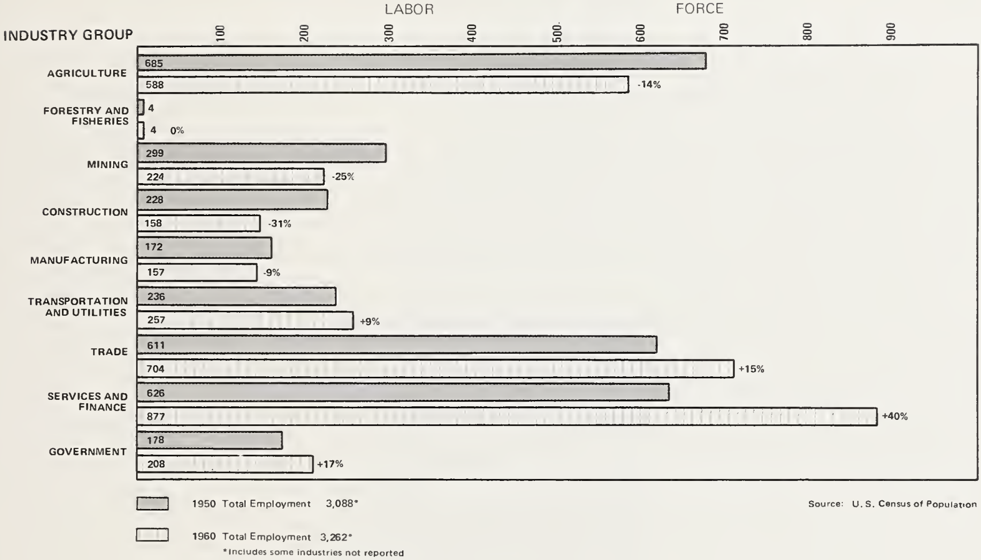
	Glacier County	Montana	United States
Agriculture	18	17	11
Forestry and Fisheries	1	1	1
Mining	7	3	1
Construction	5	7	5
Manufacturing	5	10	27
Transportation and Utilities	8	9	7
Trade	22	21	19
Services and Finance	28	26	16
Government	6	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

CHART 10

Employment Change by Major Industry Group

Glacier County 1950-1960

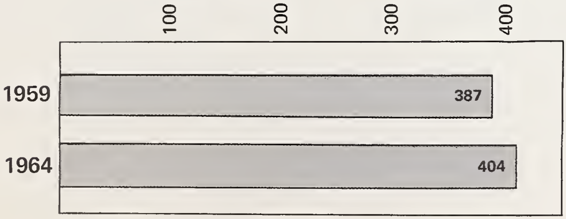


Source: U. S. Census of Population

CHART 11

Number of Farms

Glacier County 1959-1964



Source: United States Census of Agriculture, 1964

CHART 12

Farms by Size

Glacier County 1964

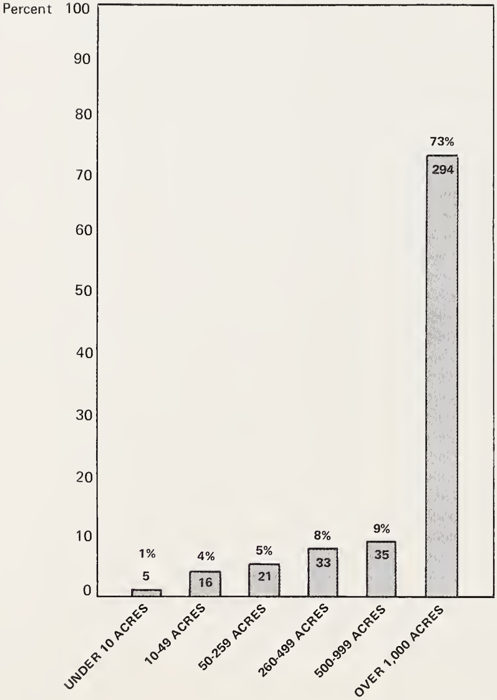
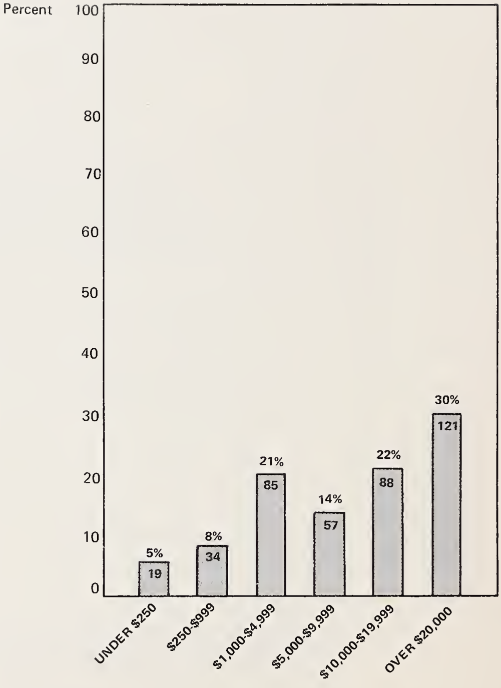


CHART 13

Number of Farms by Value of Farm Products Sold

Glacier County 1964



Source: U. S. Census of Agriculture, 1964

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Glacier County and to analyze their economic structure. At present, there are three separate local governmental units in the county involved within the scope of the water and sewer study. Included are the incorporated cities of Browning and Cut Bank, and the government of Glacier County.

A Board of County Commissioners, presided over by a chairman, governs the county. The two incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipality has power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities*

Glacier County 1969

	Revenue	Expenditures	Assessed Valuation
Glacier County	$5,253,398.44	$4,791,973.05	$51,575,602.00
Browning	Not Reported	Not Reported	Not Reported
Cut Bank	353,673.29	411,069.15	10,836,021.00

*There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

GENERAL

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major river drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can help to avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report, the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications" and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A, in Appendix I, outlines present day water quality standards as set forth by the United States Public Health Service.

SURFACE-WATER RESOURCES

Glacier County has an extensive drainage system which has characteristics of both mountainous and plains topography. Drainage within the county may be found running in almost any direction; however, the main drainage pattern is to the east northeast. In extreme eastern Glacier County, drainage along Cut Bank Creek is to the south-southeast.

Elevation differences across the county exceed six thousand feet and add to the complex surface drainage system. The highest elevations, nearly ten thousand feet above sea level, occur in Glacier National Park in western Glacier County. Elevations decrease in an easterly direction across the county, and reach levels of just over three thousand feet along the Marias River southeast of Cut Bank.

Major drainage features of Glacier County are the St. Mary, Milk, and Two Medicine Rivers and Cut Bank Creek. The St. Mary River rises near the crest of the Continental Divide and, after leaving Lower St. Mary Lake near Babb, flows approximately thirteen miles north before entering Canada. The St. Mary River forms a portion of the vast Hudson Bay drainage system.

The Milk River, which is a tributary of the Upper Missouri River, is formed from the South Fork, Dry Fork, Middle Fork, and North Fork which head in north-central Glacier County. From the confluence of the Dry Fork and Middle Fork, the Milk River flows northeast through the county for more than forty miles before entering Canada north of Cut Bank. The Two Medicine River and Cut Bank Creek head in Glacier Park in southwest Glacier County. Two Medicine River flows generally east past East Glacier and across the southern part of the county. Cut Bank Creek also flows east across Central Glacier County then turns south near Cut Bank. Near the southeast corner of the county, the Two Medicine River and Cut Bank Creek flow together to form the Marias River.

The above streams of Glacier County provide a yearlong source of water for irrigation, livestock, and municipal needs. These streams and many others in Glacier County have gaging stations installed by the United States Geological Survey where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for each gaging station pertinent to Glacier County.

Three reservoirs in Glacier County add significantly to the irrigation facilities. The largest, Lake Sherburne west of Babb, has a usable capacity of 66,200 acre-feet. Water from the reservoir is used for irrigation on the Milk River Project of the Bureau of Reclamation. The dam at Lower Two Medicine Lake near East Glacier was destroyed during the flood of June 1964 and has since been rebuilt. Water from the reservoir, which originally had a usable capacity of 16,620 acre-feet,is used for both irrigation and recreation. The third reservoir is Four Horns Lake near Heart Butte in southern Glacier County which has a usable capacity of over 16,000 acre-feet. Water from this reservoir is also used for both irrigation and recreation.

These three reservoirs have operational records on file by the United States Geological Survey. Many other reservoirs exist in the county which also add significantly to the irrigation facilities. Records and information pertaining to those reservoirs with more than fifty acre-feet of usable storage are available from the Montana Water Resources Board.

The climate of the area varies considerably from one area to another because of the wide range of topographic conditions. The effect that the topography has on the climate is very important to the water resources. Prevailing west to southwest wind flowing across the high mountains in western Glacier County provide the highest annual precipitation values, nearly thirty to forty inches. Average annual precipitation values at the lower elevations in eastern Glacier County range between eleven and twelve inches.

TABLE 6
Stream Gaging Stations

				Discharge (cfs)						Runoff - (1,000 Acre-Ft)			
Stream	Gaging Sta. Location	Drainage Area (sq mi)	See Note	Max.	Date	Min.	Date	Average	Years Averaged	Max.	Date	Min.	Date
1. St. Mary River	Near St. Mary	130		3,050	5/27/61	119	10/ 5/61	*	*	*	*	*	*
2. St. Mary River	Near Babb	177		7,980	6/ 5/08	4	2/14/11	540	13	545	1907	280.7	1905
3. Grinnell Creek	Near Many Glacier	3.47		536	6/ 8/64	0.2	At Times	25.2	18	21.38	1967	16.08	1957
4. Swift Current Creek	At Many Glacier	31.4		6,700	6/ 8/64	8.3	3/ 2/64	147	11	129	1918	88.4	1962
5. Canyon Creek	Near Many Glacier	7.2		720	6/ 8/34	0.0	9/24/36	*	*	*	*	*	*
6. Swift Current Creek	At Sherburne	64.3		2,360	6/11/64	No Flow	At Times	199	7	168	1922	115	1919
7. St. Mary River	Near Babb	278		16,500	6/ 9/64	26	1/ 5/53	793	33	776.7	1951	423	1919
8. St. Mary River	International Boundary	469	1	40,000	6/ 5/08	16	11/29/36	705	51	982	1908	228.9	1941
9. Two Medicine River	Near East Glacier	51.1		1,390	6/11/18	9	3/ 9/64	*	*	*	*	*	*
10. Two Medicine River	Near Browning	317	1	100.000	6/ 8/64	1.1	8/16/66	384	33	441	1909	160	1919
11. Badger Creek	Near Browning	133		49,700	6/ 8/64	25	12/15/63	230	16	216	1964	131.6	1961
12. Badger Creek	Near Family	239	1	*	6/ 7/08	2.0	8/18/19	217	10	257	1916	87.5	1919
13. Cut Bank Creek	At Cut Bank	1,065	1	16,600	6/ 9/64	4.0	12/ 1/05	195	32	202	1907	81.3	1919
14. South Fork Milk River	Near Babb	68.6	1	12,000	6/ 8/64	1.3	8/22/61	*	*	*	*	*	*
15. Milk River	Near Intern. Boundary	287		13,000	6/ 6/08	No Flow	9/ 2/19	97.6	5	128	1916	15.6	1919
16. Milk River	Near Del Bonita	325	1	17,300	6/ 8/64	No Flow	At Times	*	*	*	*	*	*
17. North Fork Milk River	Near Intern. Boundary	91.8	1	2,950	6/17/48	No Flow	3/ 2/40	*	*	*	*	*	*

Source: "Water Resources Survey" Glacier County, Montana
Montana Water Resources Board, Helena, Montana, 1969

*Not Recorded

Note: Irrigation Diversions occur above these stations

In general, precipitation occurs as steady rains in the spring months of April through June, intermittent showers throughout the summer and early fall months and as snowfall during the winter months. Snow does not tend to remain on the ground in the lower elevations of the county due to "chinook" wind conditions and frequent winter warming spells. Snow begins to accumulate in November in the higher mountain valleys, however, and continues to build up until late March or early April. Portions of the high mountain snowpack in Glacier County, and in other adjacent drainage areas, remain until the warm temperatures of late July and August begin to melt them. The runoff from the snowpack at this time of the year coincides with the period of maximum demand for water in the valleys below.

The use of surface water in Glacier County is widespread for domestic, industrial, agricultural, and recreational purposes. The town of Cut Bank and the community of East Glacier draw upon surface water sources for domestic purposes. Agricultural uses of water are very important to Glacier County. Over 25,000 acres are presently being irrigated, and existing facilities can handle an additional four thousand acres. A final but important use of surface water in Glacier County is for recreational purposes. The mountain lakes and streams in the county are ideal habitat for fish and water fowl and draw many fishermen and hunters to the area each year.

As is the case in most counties in Montana, water appropriated for use in Glacier County far exceeds the amount available. An example of this inequity is the comparison of the average flow of Cut Bank Creek with the appropriation for the stream and its tributaries. The appropriation on record as of 1969 was 14,388.36 cubic feet per second (cfs). As shown in Table 6, the average flow of the creek, seventeen miles above its mouth, for a thirty two year period was 195 cfs.

WATER USE CLASSIFICATIONS

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Glacier County and surrounding areas are classified as follows:

Marias River Drainage (except tributaries listed below	B–D$_2$
Cutbank Creek Drainage to, but excluding, Old Maid Miller Coulee in Cutbank except the portion of Willow Creek listed below:	B–D$_1$
Willow Creek Drainage to the Montana Highway 464 crossing about one-half mile north of Browning	B–D$_1$
Willow Creek (mainstem) from the Montana Highway No.464 crossing to Cutbank Creek (also included in the Marias River Drainage classification above)	B–D$_2$
Tributaries (if any) to Willow Creek from the Montana 464 crossing to Cutbank Creek	B–D$_1$
Cutbank Creek (mainstem) from Old Maid Miller Coulee to Birch Creek (also listed under Marias above)	B–D$_2$
Tributaries to Cutbank Creek from, but excluding Old Maid Miller Coulee (which is "B–D$_2$") to Birch Creek	B–D$_1$
Birch Creek Drainage except tributaries listed below:	B–D$_2$
Two Medicine Creek Drainage to and including the Badger Creek Drainage	B–D$_1$
Midvale Creek Drainage to the East Glacier water supply intake	A–Closed
Remainder of Midvale Creek Drainage	B–D$_1$
Summit Creek Drainage to the Summit water supply intake	A–Closed
Remainder of Summit Creek Drainage	B–D$_1$
Two Medicine Creek (mainstem) from Badger Creek to Birch Creek	B–D$_2$

Tributaries to Two Medicine Creek from Badger Creek to Cutbank Creek	B—D1
Milk River Drainage from source (or from the Glacier National Park Boundary) to the International Boundary	B—D$_1$
All waters within Glacier National Park except the portion of Swiftcurrent Creek listed below:	A—Open—D$_1$
Swiftcurrent Creek (mainstem) from the Many Glacier Chalet to Lake Sherburne	B—D$_1$
All waters outside Park from Park Boundary to the International Boundary	B—D1

GROUND-WATER RESOURCES

The widespread availability of relatively shallow ground water has been a major factor in the development of ranching and farming in Glacier County. The western part of the county has high rugged mountains with abundant water, but the central and eastern parts of the county have few streams and are dependent on wells for stock and domestic water. As of January 1970, 416 well and 179 spring appropriations were on file at the Montana Bureau of Mines and Geology. There are also numerous wells on the Blackfeet Indian Reservation, many of which are not recorded on state appropriation forms. Approximately eighty four percent of the wells reported are used for domestic and stock purposes, six percent for industry, three percent for irrigation, and three percent for public supply. Springs appropriated in the county are almost entirely used for domestic and stock purposes. The communities of Cut Bank and Browning are using ground water for municipal purposes. The only published ground-water reports available for this county are E. A. Zimmerman's study entitled "Water Resources of the Cut Bank Area, Glacier and Toole Counties, Montana", 1967, Montana Bureau of Mines and Geology Bulletin 60; and the ground-water section of the Montana Water Resources Board's "Water Resources Survey" by A. J. Mancini, 1969.

Glacier County has a wide variety of geological formations that range in age from Precambrian to Recent. The geological history of this county includes long periods of sedimentation and erosion and periods of upheaval and deformation that have created the rugged mountains. Glaciation, both local and continental in scale, has changed the landscape and left widespread deposits. The availability and quality of ground water is greatly influenced by geological conditions.

Mountains in the far western part of Glacier County are composed of hard, metamorphosed sedimentary rocks of Precambrian age (greater than 600 million years). These rocks are tightly compacted, have low porosities and permeabilities, and generally will yield only small quantities of water to wells. Eastward from the rugged mountains is a belt of mountains of moderate relief. This area is composed primarily of shales and sandstones of Cretaceous age (sixty five to 135 million years old), and is covered in many places by glacial deposits and alluvium. There has been little development of ground water in this area, but it is thought that small to moderate quantities of ground water can be obtained by wells.

The Two Medicine Formation and the Virgelle Sandstone of Cretaceous age are the two major aquifers in the county. The Two Medicine Formation is up to five hundred feet thick in this part of Montana and is a sandy shale and mudstone with a 250-foot massive, fine-grained sandstone at the base. The aquifer is partially covered by glacial deposits but is widely used for domestic and stock water. The Two Medicine formation will generally yield five to fifteen gallons of water per minute to wells.

Underlying the Two Medicine Formation is the Virgelle Sandstone. The Virgelle is about 180 feet thick and is a massive, light-colored sandstone. This formation will yield as much as 250 gallons of water per minute to wells and is widely used as a water supply in eastern Glacier County.

Beneath the Virgelle Sandstone are a number of formations that are predominantly shales and, generally, are poor aquifers and yield water of poor quality. The Madison Group of Mississippian age is found at a depth of three thousand to four thousand feet. This rock unit is composed of carbonate rocks and is capable of yielding moderate to large quantities of poor quality ground water. The Madison Group is used as a source of industrial water for secondary oil recovery.

Bedrock formations in much of the eastern, southwestern, and northwestern parts of the county are covered by glacial deposits of Pleistocene age (less than one million years old). A huge ice sheet deposited glacial moraines over most of the area east of Cut Bank. These glacial deposits are as much as 150 feet thick and are composed of dense, compacted mixtures of sand, gravel, silt, and clay. These deposits generally yield small amounts of poor quality water to wells.

Glacial ice blocked drainages in the Cut Bank area and created a large lake called Lake Cut Bank. Deposits of clay, silt, and sand accumulated in the lake to a maximum thickness of about fifty feet. These deposits generally yield very little water to wells.

Glacial deposits, derived from glaciers that advanced eastward from the mountains of western Glacier County, cover large areas in the northwestern and southwestern parts of the county. These deposits are composed of a mixture of boulders, gravel, sand, silt, and clay. There are few wells in these deposits, but general geological conditions suggested that these deposits would yield small to moderate amounts of water to wells.

TABLE 7

Chemical Analysis of Municipal Water Supplies (All Figures in Milligrams per Liter)*

City or Town	Browning	Cut Bank	Cut Bank	East Glacier
Source	Well and Springs	Cut Bank Creek	Well	Midvale Creek
Date	7/60	1/59	1/59	10/61
Total Solids	350	360	1,110	80
Hardness	291	260	354	80
Ca	68	47	50	13
Mg	29	35	56	12
CO_3	0	0	0	0
HCO_3	335	226	555	55
Cl	0	4	21	3
SO_4	66	117	437	4
Na+K	26	24	271	0
Fe	0	0.1	0.7	0.1
F	0	0.1	0.4	0
NO_3	0.6	0.4	0.4	0.2
Pb	0.05	0.1	0.013	–
Cu	0	0	0	–
AS_2O_3	0	0	0	–

* See Appendix I, Table A, for accepted water quality standards
Source: State Department of Health, Helena, Montana

Scattered terrace deposits of Tertiary or Quaternary age consisting of unconsolidated gravels are found along the mountain fronts. These deposits cover small areas and are remnants of ancient stream deposits. The terrace deposits are as much as one hundred feet thick and generally yield moderate amounts of ground water to wells and springs.

Along the major streams of the county are small deposits of unconsolidated sand, gravel, silt, and clay. These deposits are Recent in age (less than twenty thousand years) and are the result of reworking of older deposits. Small to moderate amounts of ground water can be obtained from these deposits.

Ground-water from the Virgelle Sandstone and the Two Medicine Formations in the central and eastern parts of the county contains medium to high concentrations of sodium, bicarbonate, and sulfate. These waters range in quality from fair to very poor. Water from glacial drift deposits is usually of poor quality, and water from Recent alluvium is of good to poor quality. Water in the mountainous western part of the county is generally of good quality. (See Table 7 for chemical analysis of municipal water supplies in Glacier County. See Table A in Appendix I for accepted water quality standards.)

The ground-water resources of Glacier County are not widely developed. Ground water in moderate quantities is relatively abundant, but the quality is only fair to poor. There will be continued development of ground-water for domestic and stock purposes, but municipal and irrigation use of ground water will require very careful selection of well sites to obtain good yields and suitable quality.

Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
2. State Department of Health, Helena, Montana
3. "Water Resources Survey" Glacier County Montana, Montana Water Resources Board, Helena, Montana, 1969

THE SOILS

GENERAL

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Glacier County has an interesting and quite complicated geologic history which has greatly influenced the soil structure of the area. The dominating geologic features of the county are the mountainous areas along the western county line. As a result of the advance and recession of glaciers in the area, much of Glacier County is covered by glacial till.

Also, extensive drainage from the mountains has resulted in the filling of many stream valleys with alluvial gravels. The soils of Glacier County are made up of the alterations of the parent materials due to various conditions of climate, topography, and living organisms.

SOIL MAP

The Montana Agricultural Experiment Station at Montana State University, Bozeman, Montana, in cooperation with the Soil Conservation Service and the Bureau of Indian Affairs, has published a general soils map of the Blackfeet Indian Reservation. The map covers the majority of Glacier County and a small portion of northern Pondera County. In the development of this map, field studies and observations were made which resulted in the designation of twenty four soil associations and general soil areas. Each general soil area, as a rule, contains a few major soils and several minor soils. Soils within an area may differ greatly in short distances and any one soil may occur in more than one area. Thus, the general soils map does not show the kind of soil at any particular point but, rather, shows specific patterns of soils.

The descriptions of the twenty four soil areas shown on the published map are presented in the following paragraphs. Map 4 of this report has been reduced in scale and, therefore, some of the smaller original soil areas do not appear. The overall pattern of soils in Glacier County remains apparent, however.

Soils of the Forest

1. Loberg: These are deep, stony loam soils on rolling, hilly and steep glacial till deposits. Loberg soils occupy seventy to eighty percent of the area. They have thin organic forest litter covering a mineral surface of ashy gray stony loam. The subsoil is stony clay loam. Deep, black, loam and clay loam soils occur at random on the remainder of the area.

2. Sherburne-Loberg: These are stony soils on moderately sloping to steep glacial till deposits. The two soils are about equal in extent. Sherburne soils have reddish brown topsoil under organic forest litter. Loberg is ashy gray. The subsoil of the two soils is contrasting with stony clay in Sherburne and stony clay loam in Loberg.

3. Loberg-Mord: These are steep mountainous areas of limestone and sandstone bedrock and the associated soil of footslope and hilly glacial till deposits. One third of the area consists of shallow, stony soils and rock exposures. Loberg and Mord soils share equally the other two thirds. They have thick, stony clay loam subsoils but are contrasting in surface horizons. Loberg soils have ashy gray mineral surface soil under a thin layer of organic forest litter. Mord soils have black topsoil.

Soils of the Forest-Grassland Transition

4. Adel-Babb: These are deep, black, loamy soils on rolling, hilly and steep glacial till deposits bordering the forest lands. Adel soils have a thick black topsoil. Babb soils have thinner, black topsoil, brown subsoil, and nearly white substratum.

5. Raynesford-Whitore: These are deep, loamy soils supporting grass and forest on rolling and hilly glacial till deposits derived from limestone. Raynesford soils occupy about sixty percent of the association and Whitore about forty percent. The two have similar profiles except Raynesford soils have black topsoil while Whitore topsoil is brown.

Soils of the Tallgrass Prairie

6. Leavitt-Burnette: These are deep, black loamy soils on rolling, hilly and steep glacial till deposits. Leavitt soils comprise about two thirds of the area and Burnette soils about one third. Leavitt topsoil is thinner than Burnette, Burnette soils have a more compact clayey subsoil.

7. Hanson-Babb: These are deep, loam and stony loam on hilly and steep glacial till deposits. The two soils are of about equal extent with Hanson occurring on knolls, ridges, and steep south facing slopes. Hanson soils are more stony and both have dark-colored topsoil but Babb is thicker and darker.

8. Michelson-Redchief: These are deep, black loamy soils on dissected high elevation benchlands. Both have black surface soil and brown clay loam subsoil. The substratum of Michelson is white alkaline clay loam while that of the Redchief is acid red gravelly clay. Redchief areas are commonly gently sloping. Both gently sloping and sloping phases of Michelson are common.

9. Fifer-Adel: These are dark-colored soils on hilly and steep broken uplands with shale and sandstone bedrock. Fifer soils are shallow over bedrock whereas Adel soils occur in accumulation positions and are deep. They are of equal extent.

10. Michelson-Pishkun: These are deep, black soils on nearly level benchtops, adjacent steep bench-edges, and long foot-slopes. Michelson soils account for about seventy five percent of the area. Pishkun soils are deep gravelly soils with thin, dark-colored topsoil.

11. Timberg-Litimber: These are rolling and hilly clay loam soils derived from red shale bedrock. Timberg and Litimber soils each occupy about forty percent of the area. The remaining twenty percent has very thin soils over shale and soils with dense claypans. Timberg and Litimber soils are similar in profile. Timberg soils occur in convex slope positions and are twenty to forty feet deep over bedrock. Litimber soils occupy concave slope positions and are over forty feet to bedrock.

12. Farnuf-Cabba: These are deep, cobbly loam benchland soils, separated by areas of shallow soils over shale bedrock, or seeped, saline waterways. The association is sixty percent Farnuf soils, twenty percent Cabba soils, and twenty percent seeped, saline waterways. Farnuf soils are deep and loamy with moderately thick topsoil Cabba soils are shallow, with thin, light-colored topsoil.

13. Raynesford-Hanson: These are deep, dark-colored soils on rolling and hilly stony loam glacial till from limestone sources. Both occur in about equal proportions in complex patterns. Hanson soils are on stony knolls, ridges and steep slopes with Raynesford soils between. Raynesford soils have dark-colored topsoil and nearly white subsoil. Hanson soils are lighter colored.

Soils of the Midgrass Prairie

14. Fairfield-Cabba: These are deep, loamy soils of benchlands broken by areas of shallow soils over shale bedrock. Fairfield soils of the benchland remnants occur on about sixty percent of the area. They have dark-colored topsoil and white alkaline subsoil. The Cabba soils occupy thirty percent of the area. They are light-colored and have soft shale bedrock within twenty inches.

15. Fairfield-Martinsdale: These are deep, well-drained loamy soils on smooth, nearly level benchland areas. Fairfield and Martinsdale soils cover about eighty percent of this unit; the remaining twenty percent consists of steep benchedges, wet or saline swales, and areas of shale or sandstone bedrock. Fairfield and Martinsdale soils are similar in profile features; having loam or gravelly loam topsoil, brown clay loam subsoil, and white substrata. The Martinsdale soil has a firmer subsoil and is thicker to the white substrata than Fairfield.

16. Williams-Zahl: These are deep, loamy soils on undulating, rolling, hilly, and steep glacial till deposits. Williams soils have dark-topsoil and the Zahl soils have thin light-colored topsoil. Williams soils occupy sixty to seventy percent of the area and Zahl about thirty percent.

17. Pendroy-Attewan: These are nearly level and moderately sloping areas of clayey, loamy and sandy soils on glacial lake sediments. Pendroy soils are friable clays with strong granular surface structure. Attewan soils are moderately deep, sandy or loamy over loose sands. Each accounts for about one third of the association. The remaining one third is a variety of deep loamy soils which are generally more friable than the Pendroy and which store more water than the Attewan.

18. Boxwell-Tanna: These are moderately deep, silty and clay loam soils on rolling and hilly siltstone and shale uplands. Boxwell soils are silty and Tanna soils are clay loam. They are about equal in extent and together account for eighty percent of the area. The remaining area is shallow, light-colored loam and clay loam soils on knolls, ridges, and steep slopes.

19. Attewan: These are nearly level and sloping areas of sandy loam soils over loose sands at two to three feet. About twenty percent of the area is terrace escarpment, sandstone or shale bedrock, active sand dune or vegetated loose sand.

20. Scobey-Kevin: These are deep, loamy soils on undulating, rolling, and hilly glacial till deposits. Scobey soils occupy half of the area, Kevin soils about forty percent, and other soils ten percent. The pattern is complex. Kevin soils occur on ridges and knolls and are lighter colored and have thinner topsoil than the Scobey soils. Swales and closed basins are poorly drained and small lakes are common.

21. Cabba-Wayden: These are shallow soils underlain by loamy or clayey shales on rolling, hilly, and steep uplands. Cabba soils are loamy and Wayden soils are clayey. They occur together in places but there are areas where one or the other is fairly continuous. Both soils have light-colored topsoil and are low in native fertility.

Soil of Undifferentiated Vegetation Types

22. Gallatin-Beaverton: These are deep loamy soils and shallow gravelly soils on low bottomlands and adjoining stream terraces. Gallatin soils occur on about forty percent of the area. They are deep, loamy textured and have varying degrees of natural drainage. The Beaverton soils are shallow gravelly loams underlain by loose gravel and occur on about forty percent of the area as a whole but are not common in some parts, especially along the South Fork of the Milk River. The remaining land is miscellaneous saline, wet and overflow areas.

23. Vanda: These are dense clay soils on nearly level plains bordering intermittent streams and saline lakes. The soils are sticky and puddle when wet and hard and crusty when dry.

24. Steep Broken Valley Sides: These are areas where major streams are deeply intrenched in shale or sandstone bedrock. Typically about half the area lacks vegetative cover. The remainder varies from shallow loamy or clayey soils with sparse cover to pockets of deep soil with good plant growth.

CONCLUSIONS

The soils of Glacier County have generally been easy to deal with where shallow domestic water wells and individual sewage drain fields have been constructed. The large amounts of glacial till and alluvial gravels have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drain fields. Some areas of extensive clay and silt deposits require even more care in the construction and operation of septic tank drain fields.

The actual construction of water and sewer systems in the various soils of Glacier County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse stream gravels slow operations somewhat. Some bedrock can be expected at normal water and sewer line installation depths.

Source: General Soils Map, Blackfeet Indian Reservation, Cut Bank Area, Montana Agricultural Experiment Station, Montana State University, Bozeman, Montana, Misc. Publication No. 8, November, 1969

COMMUNITY WATER SYSTEM FACILITIES

GENERAL

This comprehensive report covers the overall problems, existing or projected, for Glacier County, Montana. The volume of data processed and evaluated and the intent of the report do not allow the detailed analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

The demand for water from community water systems is basically due to three requirements. These are, sufficient water supply for domestic purposes, for fire fighting and for industrial needs. The demand for industrial water supply has not been extensive in Montana and should not control the design of most community systems. Where economic projections indicate industrial development, the anticipated demand on domestic water systems is considered. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities, a system whose capacity would give high ratings for fire protection would require a system considerably larger than necessary for domestic purposes and one that the community might be unable to finance. The approach in such cases has been to propose a system suitable for present domestic needs. These basic facilities can then be expanded for more complete service and for higher ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions making it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units and automatic washing machines. Water usage for beautifying property has also increased since the people have more leisure time. The most essential condition is adequate, safe and potable water for domestic purposes, and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

BASIC CONSIDERATIONS

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community, within this category, was visited at least once. During these visits, the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities, the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths. For such situations, private wells will provide a safe and suitable water system.
2. Many communities have had access to good water from private wells for many years. In some of these communities, population is increasing and the area is becoming more densely settled. As a result, wells tested for bacteriological quality occasionally indicate there is pollution present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the residents now with provisions for improvements and expansion as needed.
3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.
4. Some communities, which have experienced a steady population growth, are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

GLACIER COUNTY

The estimated 1970 population of Glacier County is twelve thousand. Approximately 7,370, or fifty nine percent of these people, are presently served by a central water system and the remainder are served by such private facilities as wells and springs. If the schedule of proposed improvements outlined in this report is followed, about 8,270, or sixty seven percent of the estimated population, will have access to central water systems by 1975. It is expected that the remaining thirty three percent will live in the outlying areas and the homes will not be close enough together to make central systems feasible.

CUT BANK

Existing System. The estimated 1970 population for Cut Bank and the adjacent area is 4,790. The town is expected to show only slight population increase throughout the planning period. The area presently served by the community water system is shown on Map 5. The estimated number of persons in this area is 4,600.

The supply of water is obtained from Cut Bank Creek. All of the water obtained from this creek is treated by coagulation, sedimentation, filtration and chlorination. The treated water from this source is considered to be of a very good quality. An emergency well is maintained to supplement the output from the treatment plant if the need arises. This well produces a rather poor quality water and is not considered suitable for use except during an emergency. The community presently experiences considerable shortage of water during the high demand periods of the summer months and it will be necessary to expand the water treatment facilities. Storage consists of a 1,125,000 gallon storage tank located at the southeast edge of town. This storage is considered to be adequate except that it does not provide high enough pressures for the users located in the higher areas of the town.

Improvements Next Five to Ten Years. The population is expected to remain essentially steady through 1975. A serious water shortage presently exists and even without additional population it is necessary to expand the water treatment plant. The capacity of this plant should be increased to 2,500 gallons per minute (gpm). This facility would then be adequate to serve the community's needs throughout the planning period. Also, additional water would be available and could be piped to the residents located north along State Secondary Highway 213.

Improvements by 1990. The estimated 1990 population is 4,875. Expansion of the present water treatment plant as outlined under the five to ten year improvements would result in a system which would serve the needs of this population as well as the area to the north of town. Additional storage should be developed during this period and it should be of a type which would provide higher pressures to the residences located on the higher ground near the southeast edge of the city.

BROWNING

Existing System. The estimated 1970 population for the town and the fringe areas is 2,570. The population is expected to increase substantially by 1990. A water system is presently in existence which serves the town, the Indian agency headquarters and an industrial park located to the south of the town. It is estimated that about 2,200 persons are presently served by this facility. Water supply is obtained from a series of springs located six miles west of the town. A ten inch supply line carries water to the distribution system entirely by gravity. A 100,000 gallon tank is situated about one half mile east of the spring site on the supply line to town. Storage is provided on the distribution system by means of three elevated storage tanks. A 25,000 gallon tank is located at the agency headquarters. A 75,000 gallon storage tank is located in the town itself and a 300,000 gallon tank is in existence at the industrial park. These storage facilities are all interconnected.

The amount of water available at the spring site is considered to be very large. Presently about six hundred gpm are obtained from this source. The analysis which was made for this system indicates that additional water supply would be necessary based on the analysis criteria as outlined in Appendix II. It is reported, however, that the present six hundred gpm does adequately serve their needs. This would indicate that the per capita consumption of water may be less than the averages used in this study. Additional water supply could be developed at the present spring site and, if a water shortage develops, it is recommended that this be done.

Improvements Next Five to Ten Years. The estimated 1975 population is 2,700. The present water supply is considered to be adequate to handle this increased population. The amount of water storage facility available within the town limits is not considered to be adequate. An additional 200,000 gallon storage tank should be constructed during this period.

Improvements by 1990. The estimated 1990 population is 3,075. The present system together with the proposed improvements outlined under the five to ten year period will result in a system which is adequate for this population. It is believed that per capita water consumption for this community is somewhat less than usage found in other areas of the state. Should the use of water increase substantially in this community, some shortage may become apparent. Additional water supply could be developed at the present spring site by the construction of additional infiltration piping. It is believed that the present yield could be doubled by such improvements. It is possible that increased demand may be realized during this period.

EAST GLACIER

Existing System. The estimated 1970 population is 410; however, this figure increases substantially during the summer months. The population is expected to increase steadily throughout the planning period. A water system is presently in existence. The water supply is obtained from an impounding reservoir on Midvale Creek. This reservoir is privately owned by the Glacier Park Company. A sixteen-inch supply line carries water to the community where the primary user is the Glacier Park Lodge. The system was originally developed to serve their needs. An excess amount of water was available and it was agreed that this water would be made available to the community located on the east side of the railroad. This community obtained a 100,000 gallon storage tank and constructed distribution piping to serve all of the area east of the railroad. Their system is considered to be adequate and a sufficient amount of water is available for both the lodge's and the community's needs. The additional users on the west side of the railroad made mutual agreements with the Glacier Park Company to obtain their water supply from the existing supply line. The distribution system is not laid out with any pattern to its development. Random taps were made and many branches exist in the system. Much of the piping is considered to be undersized. In summary, the area west of the railroad does not have an adequate water system with the exception of the Glacier Park Company Lodge while the area of the community located east of the railroad does have an adequate water system.

Improvements Next Five to Ten Years. The population is expected to be 420 by 1975. This figure is considered to be very much larger during the summer months. The present water supply capacity is not known exactly. It is believed to be adequate to serve the present permanent population as well as the anticipated summer demands. It is, therefore, proposed that the present facility be expanded to serve all residents of the community. A layout of the system is shown on Map 8.

Improvements by 1990. The population is expected to be five hundred by 1990. The present water system together with the improvements outlined under the five to ten year plan will result in a system which is considered to be adequate for the population needs through 1990. The only improvements which may be necessary are the expansion of the distribution system and possible replacement of sections of the existing supply line.

SANTA RITA

Existing System. The estimated 1970 population is 125. The residents of this community presently obtain their water supply from private wells or they haul their water from more suitable sources. The population of this community is expected to decline through 1990. This is primarily due to a rather poor quality water being obtainable in the area. The water is considered to have a high soda content which is undesirable for human consumption. The alternative is to haul their water which results in considerable cost to the residents.

Improvements Next Five to Ten Years. The estimated 1975 population is 115. This is a sufficient population to justify the construction of a community water system. Development of a suitable well at the site of the town is not considered to be possible. The nearest suitable source of water is located at Cut Bank about four miles to the south. Since there is considerable development along the highway between Cut Bank and Santa Rita, it is proposed that a supply line be constructed from the water system in Cut Bank to Santa Rita. It is estimated that two hundred persons would benefit by this facility. The proposed system is shown on Map 9. An alternate water well is also shown; however, the suitability of this source from a taste standpoint is questionable.

Improvements by 1990. The population is expected to reach ninety by 1990. This decline is considered to result from the lack of an adequate water system. It is felt that the present population would not decrease if a safe, suitable water supply would be available. The system proposed under the five to ten year improvements would be adequate for their needs throughout the planning period. The only improvements considered to be necessary would be the expansion of the distribution system.

BABB

Existing System. The 1970 population is estimated to be fifty seven. A community water system presently serves a few homes on the north edge of the community. This system obtains its supply from a developed spring northwest of the community. A fifteen thousand gallon storage tank is located on high ground in this area. Water is then carried entirely by gravity to the community. The amount of water available from this source is not known; however, it is reported that the supply is inadequate during certain times of the year. The water level in the spring fluctuates resulting in an insufficient amount of water. The remaining residents obtain their water supply from private wells. The community is large enough to justify the construction of a central water system to serve each residence. The population is expected to be sixty one by 1975. A water system serving each residence is proposed during this period. The layout of the system is shown on Map 10. A well capable of supplying the necessary water could be constructed as shown. Utilization of the present system should be accomplished where possible. The existing storage tank would be adequate for their needs. The present supply from the springs could be utilized also.

Improvements by 1990. The 1990 population is estimated to be sixty nine. The system as proposed under the five to ten year plan would be adequate for their needs throughout the planning period.

ST. MARY

Existing System. The estimated 1970 population is thirty five. This increases substantially during the summer months. The permanent population is expected to increase steadily throughout the planning period. The residents presently obtain their water supply from privately developed systems. Some of these facilities are quite elaborate with high yields available from their water supplies. These systems are considered to be adequate; however, it is feasible to construct a central water system.

Improvements Next Five to Ten Years. The permanent population is expected to be forty by 1975. A community water system is proposed and a layout is shown on Map 11. A well capable of producing an adequate amount of water could be developed quite easily. The system would not be difficult to construct and is economically feasible.

Improvements by 1990. The estimated 1990 population is fifty. The system proposed under the five to ten year plan would be adequate to serve the needs throughout the planning period.

BLACKFOOT

Existing System. The estimated 1970 population is fifty. The residents presently obtain their water supply from private wells. The quality of the water is considered to be quite good, while the quantity is variable, depending on the type of well which has been constructed. Most families have an adequate quantity of water available to them. The wells are considered to be shallow with depths of about seventeen feet. These systems are considered to be adequate for the needs throughout the planning period.

COMMUNITY SEWER SYSTEM FACILITIES

GENERAL

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes is an important and necessary use of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes, if discharged into water courses, can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution, by definition and interpretation, is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy, established by the state legislature, to maintain reasonable standards of purity for the waters of the state. These standards are to be consistent with the use of these waters and including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act, in reference to pollution abatement, gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications" and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana, have been included in Appendix I.

Sewage may be derived from three broad categories. These are domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution and are mentioned for that reason. It is realized that they must be controlled and prevented from entering streams or other potential water supplies.

Industrial activity throughout Montana has been limited; however, the need for control and treatment of industrial wastes is very apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration in this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. Situations of this type are considered to be few and the general approaches outlined in the "Analysis Criteria" in Appendix III will suffice in practically all cases.

BASIC CONSIDERATIONS

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitably used for sewage disposal.

Community sewage collections and disposal systems are much more desirable when economically feasible. They eliminate the individual worry associated with private septic tanks and the danger of well contaminations or saturation of the soil are also removed. It is only when homes are spread over a large area that community sewage facilities cannot more economically serve a community's needs.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal; however, the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an excellent method of sewage disposal and usually are the most economical.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial waste shall be secondary treatment or its equivalent. For domestic sewage, either mechanical treatment plants or stabilization ponds which are properly designed and operated meet these requirements.

A schedule has been established by the State Department of Health whereby most communities in the state have been given a target date for completion of secondary treatment facilities. This date has been included for each of the towns where applicable.

GLACIER COUNTY

Approximately 7,300 people, or sixty one percent of the Glacier County population, are presently served by community sewage facilities. The proposed expansion program outlined in this report would result in about 8,760, or sixty two percent of the 1990 population, having access to community facilities. The remaining thirty eight percent will live in outlying areas and the homes will not be close enough together to make community systems feasible.

CUT BANK

Existing System. At the present time it is estimated that 4,600 persons are served by the community sewer facility. The collection system is adequate for the population. A forty acre wastewater stabilization pond provides treatment for the sewage. This treatment facility is not considered to be adequate for the present needs and will have to be expanded in the near future. The lift stations, trunk lines and force mains are of adequate size for present sewage flows.

Improvements Next Five to Ten Years. The estimated 1975 population for the town and the fringes is 4,790. Map 13 shows the proposed service area and the necessary expansion of the present system to provide service. The wastewater stabilization pond will have to be expanded during this period and a ten acre addition is proposed by 1975.

Improvements by 1990. Population is predicted to be 4,875 by 1990. This entire population can be served by the present system with the additions as shown on Maps 13 and 14. Minor expansion of the collection system may be necessary to serve additional areas.

BROWNING

Existing System. It is estimated that about 2,200 persons are presently served by the community sewer facility. Many improvements have been made throughout recent years which have resulted in a system which can be expanded to serve the needs of the entire community. Construction of a new outfall line and an addition to the stabilization pond are presently proposed.

Improvements Next Five to Ten Years. The estimated 1975 population is 2,700. A ten acre addition to the wastewater stabilization pond is proposed by 1975. Some expansion of the collection system may also be necessary during this period in order that new areas may be served.

Improvements by 1990. The population is expected to be 3,075 by 1990. A seven acre addition to the wastewater stabilization pond will be necessary to serve this population. The only other improvements which may be necessary would be expansion of the collection system to serve new areas.

EAST GLACIER

Existing System. The estimated 1970 population is 410. Practically all of this population is presently served by a community sewer system. The entire area east of the railroad tracks has a system which adequately serves their needs. Sewage disposal is handled by means of a septic tank and a series of holding ponds. These treatment facilities are not considered to be adequate and the State Department of Health has set the date July 1, 1972, as the deadline for constructing adequate treatment facilities. The area located on the west side of the railroad tracks could feasibly be served by a community sewer system. The population of this area increases a great deal during the summer months. Private septic tanks and cesspools are now used for sewage disposal and some of the users are experiencing difficulty in the operation of these facilities.

Improvements Next Five to Ten Years. The 1975 population is expected to be 420. It is proposed that a community sewer system serving each user in the community be constructed. Map 16 shows the proposed layout. A new wastewater stabilization pond is proposed to serve the entire area. The existing outfall line will be adequate for the additional sewage flows from the west portion of the community.

Improvements by 1990. The population is expected to be five hundred by 1990. This is considered to be the permanent year round population; however, the summer residency will increase greatly. The sewage collection system proposed under the five to ten year plan will result in a system which is adequate for the 1990 population. It may be necessary to enlarge the treatment facilities; however, the need for this will be based on the amount of summer population which actually develops. Some expansion of the collection system may be necessary to serve new areas.

SANTA RITA

Existing System. The estimated 1970 population is 125. Sewage disposal presently consists of private septic tanks or outhouses. These septic tanks reportedly function satisfactorily if a large enough drain field is installed.

Improvements Next Five to Ten Years. The population is expected to be 115 by 1975. This decrease in population is believed to result from a lack of adequate sanitary facilities. It is feasible to construct a community sewer system and it is proposed that the facility be constructed during this period. Map 17 shows the proposed system.

Improvements by 1990. The population is expected to be ninety by 1990. The proposed system under the five to ten year plan would be adequate to serve the needs throughout the planning period.

BABB

Existing System. The estimated 1970 population is fifty seven. The residents presently use private septic tanks to provide sewage disposal. The soil is gravelly and the systems reportedly function satisfactorily.

Improvements Next Five to Ten Years. Population is expected to increase steadily throughout the planning period with a population of sixty one by 1975. It is expected that the present sewage disposal facilities will adequately serve the needs through this period.

Improvements by 1990. The population is expected to be sixty nine by 1990. A community sewer system facility is proposed during this period. A layout of the proposed system is shown on Map 18.

ST. MARY

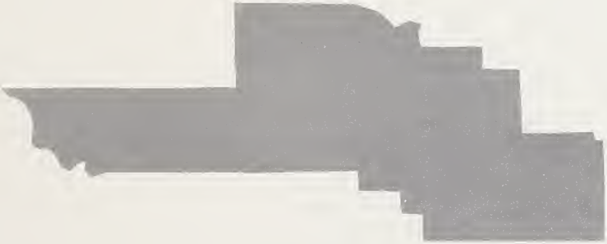
Existing System. The estimated permanent population for 1970 is thirty five. The summer population is much greater resulting in a substantial demand for a community sewer system. Sewage treatment is presently handled by means of privately owned septic tanks. The soil is gravelly and rocky so that sewage effluents readily drain away.

Improvements Next Five to Ten Years. The estimated 1975 population is forty. The summer population is very much greater as previously mentioned. It is because of this summer population that a community sewer system facility is considered to be feasible. Map 19 shows the proposed system.

Improvements by 1990. Estimated 1990 population is fifty. The system as proposed under the five to ten year plan is considered adequate for their needs throughout the planning period.

BLACKFOOT

Existing System. The estimated 1970 population is fifty. The residents presently use private septic tanks and cesspools for sewage disposal. The soil reportedly absorbs sewage overflows quite readily. No operational problems were reported with their present facility. Population is expected to decrease throughout the planning period. The present methods of sewage disposal are considered to be adequate for their needs throughout the planning period.



PONDERA COUNTY

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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

CONCLUSIONS

The total population of Pondera County is expected to decline during the planning period. The population decrease is expected to take place primarily in the rural areas of the county. Of the towns, Valier is expected to lose the most population and the communities of Brady, Dupuyer, and Heart Butte will show some decrease. The town of Conrad is expected to show considerable growth through 1990.

The existing community water and sewer systems are generally considered in good condition; however, some improvements are considered to be necessary for each of the systems. Dupuyer and Heart Butte do not have community sewer or water systems at this time; however, systems are feasible and could be constructed. Generally, those persons residing within the corporate boundaries of the towns have access to the community system, but developments adjacent to these boundaries do not. It is feasible for the present systems to be expanded to provide service to these areas and it is proposed that this be done.

This plan shows where enlargement of existing facilities would serve additional areas. Layouts for new systems have been proposed where population is expected to increase or where sufficient demand now exists to make systems feasible.

RECOMMENDATIONS

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P. O. Box 850
Bozeman, Montana 59715

Federal Water Pollution Control Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health,
Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and
Urban Development
Assistant Regional Administrator
Region VI Northwest Area Office
197 New Customs House
721 19th Street
Denver, Colorado 80904

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

PRIORITIES

That a particular system requires immediate improvements and another system will be satisfactory for a definite period is difficult to establish. But several indicators for establishing priorities are available. The general health of the people is the prime consideration and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefiting by any improvement must also be considered. These basic criteria were used in establishing the following priority listings:

1. **Conrad Water System.** The total number of persons benefiting from the improved water quality make this project very important. The lack of storage facilities within the town itself is considered to be an undesirable situation and one that should be remedied.

2. **Conrad Sewer System.** The existing wastewater stabilization pond does not have sufficient capacity to handle the sewage from the present population. Elimination of a potential pollution problem is considered to be adequate justification for the proposed expansion of the treatment facility.

3. **Heart Butte Water System.** The present lack of an adequate and safe water system makes this project very necessary. The number of persons who would benefit make the project feasible.

4. **Heart Butte Sewer System.** The present lack of adequate sanitary facilities makes this project necessary and feasible.

5. **Dupuyer Water System.** The potential health hazard presently in existence with the combination of shallow wells and septic tank drainfields makes this project necessary and feasible.

6. **Dupuyer Sewer System.** The elimination of a potential health hazard makes this project necessary and feasible. There is a large enough population in the community to justify the proposed improvement.

7. **Brady Water System.** The present taste and odor problem and the intermittent disruption of service due to maintenance problems make this project necessary. The number of persons who would benefit from the improvement makes the project feasible.

8. **Valier Water System.** The number of persons who would benefit by the improved water service resulting from the proposed improvements makes the project feasible.

9. **Brady Sewer System.** Elimination of a potential health hazard makes this project necessary.

This list of priorities is not intended to govern the order in which action should be taken. The order merely ranks the severity of the problems and the need for improvements.

THE LAND

GENERAL CHARACTERISTICS

Pondera County is in the northwestern part of the State of Montana. Bounded by the counties of Flathead, Glacier, Toole, Liberty, Chouteau and Teton, Pondera County covers an area 1,654 square miles. Eleven square miles of this area is water made up mostly by small rivers and reservoirs. The largest water surface area is Lake Frances which lies in the general center of the county.

As seen from the topography on Map 1, Pondera County is characterized by elevations that are high in the west and that gradually slope down to lower elevations in the eastern part of the county. The Rocky Mountains, in the western part of the county, reach elevations over 8,000 feet above sea level while the rolling hills and plains of the eastern part of the county have elevations as low as 3,100 feet. Population in the county is distributed fairly evenly.

Pondera County is served by two federal highways and numerous state and county secondary roads. U. S. 91 bisects the eastern half of the county and, passing through Conrad, leads to Shelby in the north and to Great Falls in the south. U. S. 89 also runs north and south dividing the western half of the county. This federal highway also connects Pondera County to Great Falls but leads to Browning rather than Shelby in the north.

Rail transportation in Pondera County is limited to freight trains and is furnished by the main line of the

Burlington-Northern Railroad. Running north and south, this line serves Conrad and the community of Brady twice daily. A secondary railroad, Montana Western, leads westward from Conrad, finally terminating at the community of Valier.

Although there are no commercial aircraft landing fields in Pondera County, there is a public landing field at Conrad. This field is paved but there are no service facilities available. There is also an unpaved field with limited service facilities at Valier. Daily air services and connections to nation wide airlines are available at Great Falls and Cut Bank.

Pondera County lies within the Great Falls Division power service area of the Montana Power Company. Major power lines of the Montana Power Company come from hydroelectric generating stations in Great Falls and terminate at Conrad; dissemination through various smaller power lines occurs from that point. Power for the community of Brady is provided by the Brady Rural Electric Administration which works in conjunction with the Montana Power Company.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

Telephone service in Pondera County is provided by two companies and one cooperative. The Mountain States Telephone Company serves the area around and between the communities of Conrad and Valier. The Three Rivers Telephone Cooperative serves the extreme eastern end of the county and also an area in the middle western part around Dupuyer. The northwestern tip of the county is served by the Browning Telephone Company.

LAND OWNERSHIP AND USE

Of the landowners in Pondera County, private ownership is the largest with forty four percent of the land. The federal government and the Blackfeet Indians each own about one quarter of the land and the State of Montana is the smallest land holder, holding six percent. Land ownership is indicated on Chart 1 and shown geographically on Map 1.

The general breakdown of land use, indicated on Chart 2, shows that almost nine out of every ten square miles of Pondera County is in either farms or ranches. This large proportion is reflected in that wheat farming is Pondera County's most important industry. Eight percent of the county is made up of the Lewis and Clark National Forest. Commercial activities such as oil fields account for three percent of the land area. The remaining small percent of the county is utilized diversely for such purposes as townsites and transportation routes.

NATURAL RESOURCES

In 1927 oil was discovered in what was to be named Pondera Field in Pondera County. Although the majority of this field lies in an area southwest of Conrad, a small part does extend south into Teton County. There are presently 281 oil wells on Pondera Field. In 1958 a smaller oil field, Gypsy Basin, was opened to the west of Pondera Field and this also was on the southern border of Pondera County. Gypsy Basin contains four wells. From these two fields comes the majority of the petroleum in the county. Ten of the existing oil wells were drilled in 1968 and were the result of fifteen exploratory drillings. There are no gas wells currently producing in the county.

Coal is another natural resource of Pondera County. The Blackfeet-Valier coal area begins in Cascade County approximately thirty miles south of Chouteau and extends north in a belt that varies in width from six to sixteen miles through Teton, Pondera and Glacier Counties. The greatest amount of mining has occurred in that portion of the field lying within Pondera County. In 1949 original coal reserves, consisting predominately of bituminous coal, were estimated at 21.89 million short tons.

The remaining mineral resources of importance to Pondera County consist mainly of construction materials in the form of sand, gravel, and stone.

The forests of Pondera County cover 106,637 acres and lie almost entirely within the Lewis and Clark National Forest. In 1969 the county received $1,376.15 from the federal government for timber cut in this forest. Approximately ten species of timber are in this forested area, the most common of which are larch, Douglas fir, spruce, Ponderosa pine, and white pine. Products from these forests include lumber, poles, pilings, railroad ties, and Christmas trees. Many commercial timber areas are either inaccessible or too scattered to be logged economically. There are no private commercial timbering operations in Pondera County.

The recreational potential of Pondera County has not been fully explored. Forest and mountain areas of the Lewis and Clark National Forest cover the western portion of the county. This is a rugged wilderness area and opportunities for such outdoor sports as hiking, mountain climbing, camping and snowmobiling abound. Alkali Lake and Lake Frances are two of the water surface areas in the eastern portion of the county that provide such water related recreation as boating and swimming.

The mountains of the western portion of Pondera County harbor elk, bear, bighorn sheep, and goat which provide excellent hunting. In more easterly parts of the county, antelope, and mule and whitetail deer abound. Bird hunting ranges from grouse hunting in the mountainous areas to pheasant, partridge and water fowl hunting on the lower elevations. The Snow Goose and Canadian Honker can also be found in very limited numbers in the areas around Lake Frances. The larger bodies of water such as Lake Frances and Swift Reservoir, plus the many smaller farm ponds, provide excellent fishing for such prize game fish as rainbow and cutthroat trout and salmon.

As interest in outdoor activities increases, the importance of recreation to the county will increase.

Statewide recreation areas are shown on Map 2.

SOILS

The majority of the soils in Pondera County are generally those of the agricultural type. The farm supporting quality of this soil is reflected by agriculture being the industry most important to the economy of the county. In the extreme western part of the county, the soils are of the forested types found in the higher elevations.

Soils data is covered in detail later in this report.

WATER

The importance of water as a major natural resource of Pondera County is shown by the fact that reservoir areas such as those at Swift Reservoir and Lake Frances which have a combined water storage capacity of 142,000 acre feet have been constructed. As previously mentioned, farming is the major industry in the county and the importance of water to this industry can be seen in the 124,600 acres of irrigated land within the county.

Water resources are covered in detail later in this report.

CHART 1

Land Ownership

Pondera County

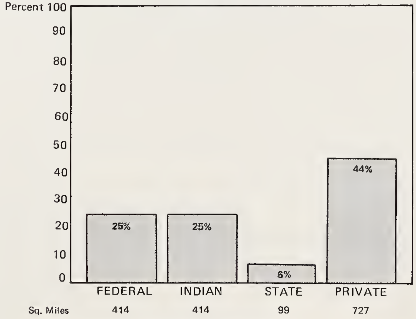
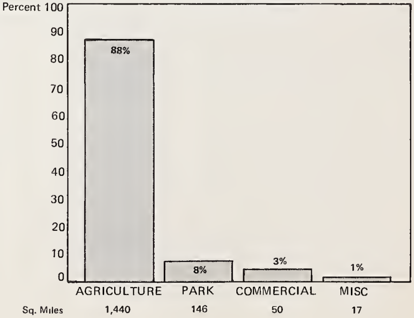


CHART 2

Land Use

Pondera County



Sources:
1. U. S. Bureau of Land Management
2. U. S. Bureau of Indian Affairs
3. The Montana Almanac, 1959-60

THE PEOPLE

POPULATION

For analytical and projective purposes, it is useful to study the population history of Pondera County to find out what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that of the State of Montana and indicates the future growth for both.

The growth pattern for Pondera County has varied since 1920. A gain was recorded in 1930 followed by a steady decrease for the next twenty years. A gain was noted between 1950 and 1960 and the projected population pattern to 1990 will not vary significantly over that established in the 1950-1960 decade. The economic structure of the county indicates that a decline will occur in the number of farm residents. Since this area is predominately agricultural, this reduction in farm population will be indicative of county population trends.

The United States Bureau of the Census has classified Pondera County as a semi rural area containing at least one incorporated place of 2,500 or more persons. Table 1 indicates that the urban population experienced a thirty percent growth from 1950 to 1960 and a slower rate of almost nine percent from 1960 to the present. The majority of the population, however, can be classified as rural or living out of the incorporated areas. Over half of those living in rural areas, as indicated in Table 1, are presently living on farms. The farm population in Pondera County has declined on an average of over eight percent for each decade since 1950, and it is anticipated that the pattern of decline will continue throughout the planning period.

The population of the county increased by 1,261 persons during the period of 1950 to 1960. Chart 4 indicates that although the county recorded a net change of 527 persons moving out of the county, the gain is explained by a recorded 1,788 births over deaths.

The change in sex composition for the county from 1950 to 1960 is shown in Chart 5. As shown, the number of both sexes has remained fairly even over the ten year period with a slight preponderance of males over females. Females are increasing in total numbers, however, and should slightly outnumber the males in the near future. The age distribution by sex for 1950 and 1960 is shown in Table 2. The largest population gain is noted for those under nineteen years and for those over thirty five years of age.

A total of six towns and communities were studied in Pondera County. The list includes the two incorporated towns of Conrad and Valier, and the four unincorporated communities of Brady, Dupuyer, Heart Butte, and Ledger.

Because of the time passed since the 1960 Census, current population estimates had to be derived from several sources in the field. Field surveys and interviews have been undertaken to determine what now exists and what is expected in the future. Table 3 indicates the past population experience for the communities and the pattern for the future.

Over the next twenty years the town of Conrad will continue to serve as the main urban center for the county. During the same time the central area population will experience an increase of more than twenty percent. The areas immediately adjacent to the town will also grow at a rate greater than the town itself, but the actual gain will only be about fifty persons. Future growth for the Conrad area should occur in the northwest part of town and in the fringe area east of Highway 91.

Valier is the second largest town in Pondera County and is located at a terminus of the Montana Western Railroad. The population of Valier has remained stable since 1950, but, as indicated in Table 3, the number of persons in the community will drop by 1990.

The remaining communities of Brady, Dupuyer, Heart Butte, and Ledger will all experience a slight population drop by 1990 and thus remain much as they are today.

It should be emphasized that these population figures reflect only those factors and trends for which there is available information. New technological advances, new industries, and other unforeseen actions may alter the population forecasts given. If such an event occurred, the affected areas should be re-examined in light of the new condition.

HOUSING

In 1960 there were 2,415 housing units within Pondera County. Chart 6 indicates a fairly even dispersion of housing by classification type. Just less than one third were farms, while more than one third were urban, and an equal number were rural non farm. The median housing size was 4.40 rooms per unit and the median household size per occupied unit was 3.63 persons. Of the total units, almost two out of every three were owner occupied while more than one fourth were renter occupied. The remaining thirteen percent or one in eight were recorded as vacant. The condition of housing in 1960 is shown in Chart 8 which indicates that only one percent was in need of replacement, while only one home in ten needed repairs. The remaining eighty eight percent were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of the source of water, water supply, and method of sewage disposal. For geographical reference, the data shows the status for Pondera County, as a whole, the urban areas, the farms, and the rural non farms.

More than half of all the homes in Pondera County were served by a public water system or by a private company in 1960. Those served included almost all the urban homes but less than half of those lying outside the city limits. In the country, less than one home in five utilized wells as their source of water while more than one third of all farm units relied on that source. Almost one third of all homes in the county used sources other than wells, public systems, or private companies for their water. Those resorting to other sources were not located in the urban areas but, rather, represented sixty percent of all farms and almost one third of the rural non farm dwelling units.

In 1960 eighty four percent of all homes in Pondera County had piped in water. The rural non farm area had three units out of four without inside water. The remainder of the rural non farm units did not have any piped in water, nor did one out of five farms.

About half of all homes in the county had access to a public sewer in 1960. These included all the urban dwellings and one third of the rural non farm homes. Only five farms were connected to public sewer. One third of the dwelling units in the county relied on septic tanks or cesspools and three fourths of the farms used the same method for sewage disposal. About one fifth of all dwelling units in Pondera County did not have access to either a public system or to septic tanks or cesspools. That figure includes one third of the rural non farm units and one fourth of all farms. Outdoor privies probably served that need.

In terms of source of water, water supply, and sewage disposal, the urban areas of the county appear to have been adequately served in 1960. The rural non farm areas indicate that some attention is needed in terms of water supply and sewage disposal.

TABLE 1

Urban-Rural Population Changes for Pondera County 1950-1970

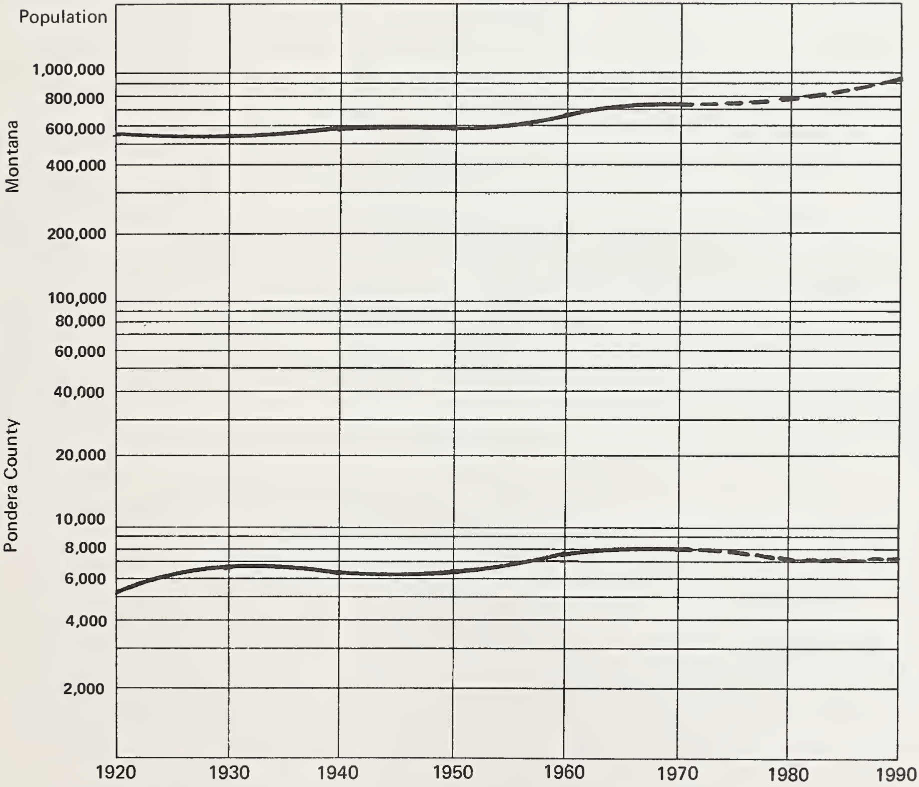
			Changes	1950-1960			Changes	1960-1970
	1950	1960	Number	Percent	1960	1970	Number	Percent
Total	6,392	7,653	+1,261	+19.7	7,653	8,000	+347	+ 4.5
Urban (Inc. Towns)	2,575	3,389	+ 814	+31.6	3,389	3,690	+301	+ 8.9
Rural	3,817	4,264	+ 447	+11.7	4,264	4,310	+ 46	+ 1.1
Farm	2,868	2,673	- 190	- 6.6	2,673	2,400	-273	-10.2
Non Farm	954	1,591	+ 637	+66.8	1,591	1,910	+319	+20.1

Sources: 1. U. S. Census of Population
2. Intermountain Planners, Inc.

CHART 3

Comparative Population Trends

Pondera County and Montana 1920-1990

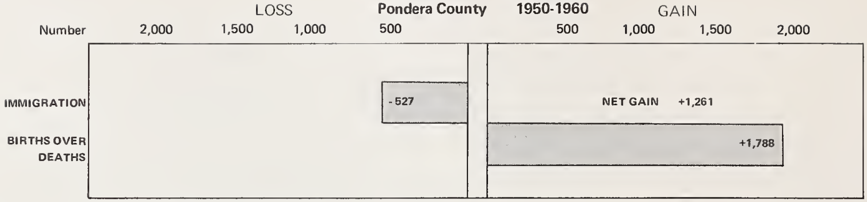


Sources: 1. U. S. Census of Population
2. Intermountain Planners, Inc.

CHART 4

Population Change

Pondera County 1950-1960

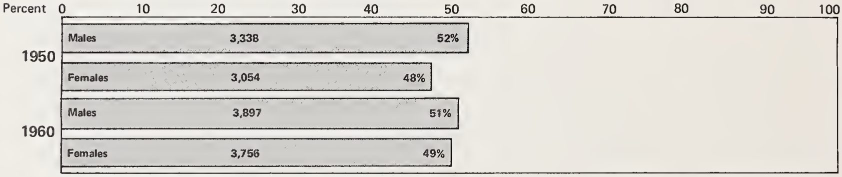


Sources: Net Migration of Population, 1950-60 by Age, Sex and Color, U. S. Department of Agriculture

CHART 5

Population by Sex

Pondera County 1950-1960



Source: U. S. Census of Population

Housing

Pondera County 1960

CHART 6

Housing Classification

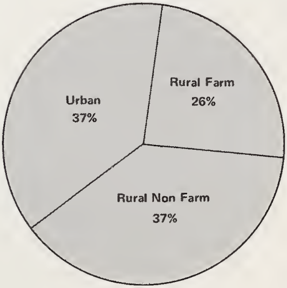


CHART 7

Housing Tenure

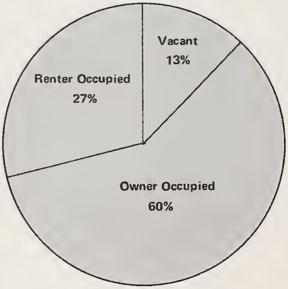
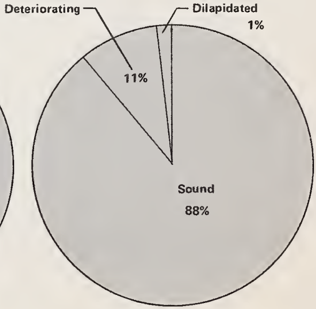


CHART 8

Housing Condition

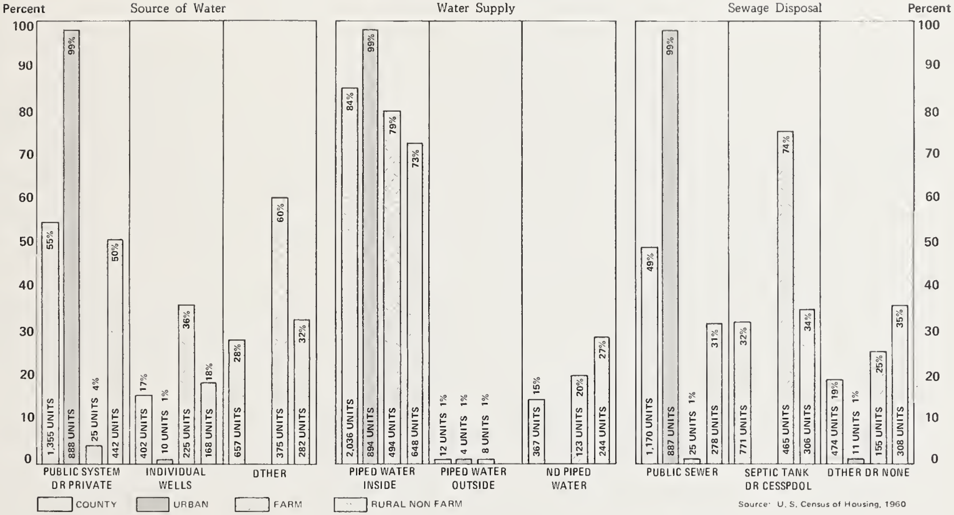


Source: U. S. Census of Housing, 1960

CHART 9

Water and Sewer

Pondera County 1960



Source: U. S. Census of Housing, 1960

TABLE 2

Age & Sex Composition of Pondera County

Age Group	1950 Male	1950 Female	1960 Male	1960 Female
Under 5	445	439	484	532
5–14	633	633	905	905
15–19	235	226	317	312
20–24	211	214	205	183
25–34	512	493	459	450
35–44	432	355	474	478
45–54	319	273	420	348
55–64	300	241	287	255
65–74	182	120	234	192
75 +	69	60	112	101
Total	3,338	3,054	3,897	3,756

Source: U. S. Census of Population

TABLE 3

Population Forecast for Towns and Communities Pondera County

	1950	1960	1970	1975	1980	1990
Conrad	1,865	2,665	2,800	2,925	3,080	3,400
Fringe	NA*	NA*	175	190	205	225
Valier	710	724	722	712	700	675
Brady	180	250	225	220	220	215
Dupuyer	115	125	120	115	110	100
Heart Butte	100	250	175	175	170	165
Ledger	15	15	17	15	15	14

*Not Available

Sources:
1. U. S. Census of Population
2. Intermountain Planners, Inc.

THE ECONOMY

LABOR

People are important to the economy of Pondera County because they are both producers and consumers of goods and services. The following analysis is concerned primarily with the total economic spectrum and how it may affect the future of the county. Changing economic conditions can have either a good or a bad effect on an area in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

Pondera County had an employment growth rate of fifteen percent between 1950 and 1960. The rate of employment growth was much greater than that for Montana as a whole which recorded a six percent gain over the same period.

The past employment change by major industry group is shown in Chart 10. The most significant change is found in the services and finance industry group, the second highest employment category, which increased by fifty eight percent over the ten year period. The trade industry group recorded a twenty four percent increase from 1950 to 1960 to make it the third highest employment group in the county.

The agriculture industry group remained the mainstay for the economy in Pondera County in 1960 as it had in 1950. This industrial group only recorded a four percent employment drop in ten years, thus following established national trends. The agricultural picture will be covered in greater detail in the following section.

The percentages for employment by industry group, as shown in Table 4, give an insight into the employment characteristics of Pondera County. This table shows the relative weight of each industry group in the county and offers a comparison with that existing in 1960 for the State of Montana and for the United States.

As mentioned earlier, the agricultural industry is the largest economic unit in Pondera County. Thirty nine percent of all employment was found in that group in 1960, or at a rate more than twice for the state and almost four times that for the nation. Manufacturing played a very minor role in the county with an employment rate only one fifth of that for the state and substantially less than that for the United States.

The available labor statistics for 1969 indicate a general decrease in employment in all industry groups except for agriculture. It appears that farming will continue to assume an increasingly important role in the economic picture. There are no major urban centers located within the county and, as a result, Pondera County will remain rural in nature.

Agricultural products will continue to play an important role in the economy of the county. The services and finance industry group should note an increase in those activities related to agricultural needs.

AGRICULTURE

A farm is defined by the United States Census Bureau as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 610 farms in Pondera County in that category in 1964, or three percent fewer than there were in 1959.

The 1964 classification of farms by type in Pondera County was as follows:

Field crop farms other than vegetables, nuts, and fruit		430
Cash grain	430	
Poultry farms		2
Dairy farms		6
Livestock farms other than poultry and dairy		118
General farms		17
Miscellaneous and unclassified		37
Total		610

Of the total number of farms, twenty three were classified as part time and twelve were classified as being operated by semi retired persons.

Farms in the county were generally large and about seventy percent produce primarily grain crops. In 1964 the average farm size was 1,510 acres. Chart 12 indicates that more than half of all farms exceeded one thousand acres in size. At the same time less than one farm in seven was under 259 acres.

The value of products sold by the number of farms further indicates the size of the agricultural operations. As seen in Chart 13, two farms out of three reported sales in excess of $10,000 in 1964 while over one third of all farms noted sales over $20,000.

The following cash receipts data for Pondera County from 1964 to 1967 gives an indication of the importance of the sale of crop products to the agricultural industry.

Year	Livestock	Crops	Total
1964	$2,300,100	$ 6,727,300	$ 9,027,400
1965	$2,822,600	$ 9,076,800	$11,899,400
1966	$3,343,900	$10,962,900	$14,306,800
1967	$3,086,500	$ 9,514,700	$12,601,200

In 1964 the sale of crops accounted for three fourths of the total value of all products sold in the county. Throughout the four year period the preponderance of crop sales over livestock sales remained the same and indicates the importance of crops in the agricultural economy.

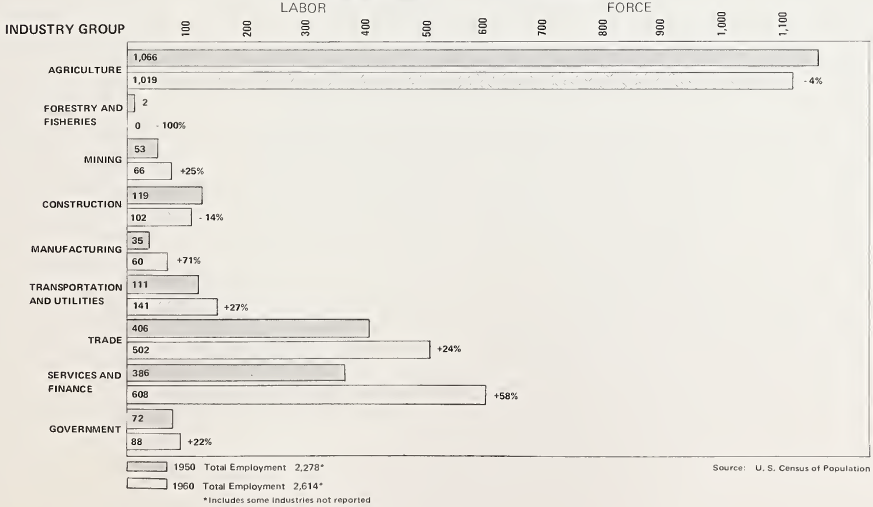
The western part of the county is used primarily for stock grazing and irrigated farms while the eastern portion of the county is mainly used for dryland wheat operations.

The outlook for agriculture in Pondera County is to continue as it has in the past. There will be a gradual reduction in the number of farms as small farms are replaced by larger operations and by the growth of the rural non farm population.

CHART 10

Employment Change by Major Industry Group

Pondera County 1950-1960



Source: U. S. Census of Population

TABLE 4

Percent of Total Employment by Industry Groups Pondera County, Montana and United States 1960

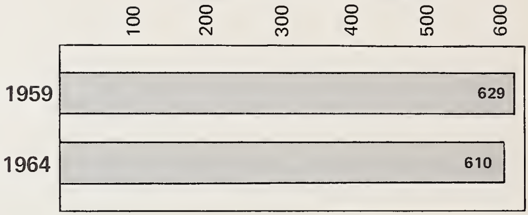
	Pondera County	Montana	United States
Agriculture	39	17	11
Forestry and Fisheries	0	1	1
Mining	3	3	1
Construction	4	7	5
Manufacturing	2	10	27
Transportation and Utilities	5	9	7
Trade	20	21	19
Services and Finance	24	26	16
Government	3	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

CHART 11

Number of Farms

Pondera County 1959-1964



Source: U. S. Census of Agriculture, 1964

CHART 12

Farms by Size

Pondera County 1964

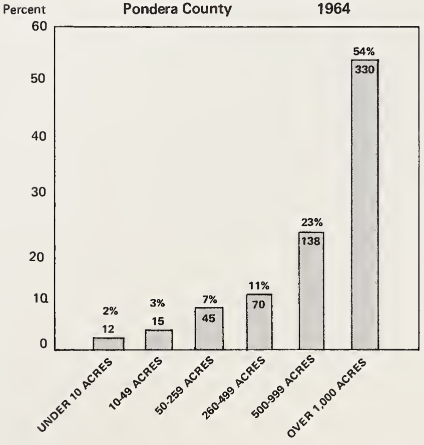
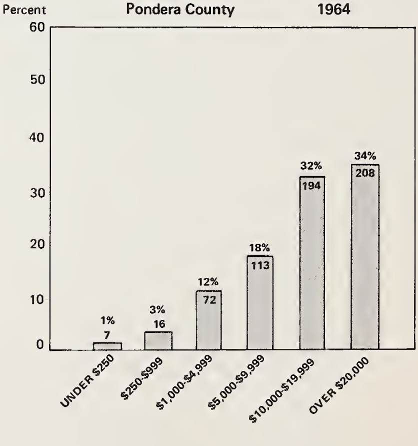


CHART 13

Number of Farms by Value of Farm Products Sold

Pondera County 1964



Source: U. S. Census of Agriculture, 1964

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Pondera County and to anlayze their economic structure. At present, there are three separate local governmental units involved within the scope of the water and sewer study. Included are the incorporated cities of Conrad and Valier, and the government of Pondera County.

A Board of County Commissioners, presided over by a chairman, governs the county. The two incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipality has power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities*
Pondera County 1969

	Revenue	Expenditures	Assessed Valuation
Pondera County	$2,803,888.61	$3,356,542.45	$49,965,430.00
Conrad	349,688.63	329,668.08	10,173,739.00
Valier	42,279.22	41,115.35	2,303,839.00

*There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

GENERAL

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major river drainages. Water is essential for many human needs, with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and thus degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can help to avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report, the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and groundwater resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A, in Appendix I, outlines present day water quality standards as set forth by United States Public Health Service.

SURFACE-WATER RESOURCES

Pondera County has an extensive drainage system which has characteristics of both mountainous and plains topography. Drainage within the county may be found flowing in almost any direction; however, the main drainage pattern is to the east northeast. Elevation differences across the county exceed five thousand feet and add to the complex surface drainage system. The highest elevations, nearly eight thousand feet above sea level, occur along the Continental Divide in the western part of the county. Elevations decrease in an easterly direction across the county and reach levels at just over three thousand feet along the Marias River north of Conrad.

The Marias River is the major drainage feature of Pondera County. The Marias, which is formed in north central part of the county, flows approximately twenty miles before entering Toole County southwest of Shelby. For nearly fifteen miles, the Marias River forms the border between Pondera and Toole Counties and is an important tributary to the Upper Missouri River.

Other important streams in the county drainage system are Birch Creek, Dupuyer Creek, Two Medicine River, Dry Fork of the Marias River, and Pondera Coulee. Birch Creek leaves the Swift Reservoir in western Pondera County and flows in a northeasterly direction through the county for approximately fifty miles before joining Cut Bank Creek in Glacier County to form the Marias River. Dupuyer Creek enters Pondera County southwest of Dupuyer and flows northeasterly approximately twenty five miles before joining Birch Creek west of Valier. The Two Medicine River flows easterly through north central Pondera County approximately twenty miles and joins Birch Creek about four miles upstream from the headwaters of the Marias River. The Dry Fork of the Marias River drains much of the central and eastern portions of the county. The Dry Fork enters the county south of Dupuyer, flows north and east through the county for approximately sixty miles, and enters Toole County south of Shelby. Pondera Coulee carries much of the drainage from extreme eastern and southeastern Pondera County. It heads west of Conrad and drains generally eastward for more than fifty miles before entering Chouteau County.

These streams provide a yearlong source of water for irrigation, livestock, and municipal needs. Many of these streams have gaging stations installed by the United States Geological Survey where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for each gaging station pertinent to Pondera County.

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TABLE 6
Stream Gaging Stations

Stream	Gaging Sta. Location	Drainage Area (sq mi)	See Note	Discharge (cfs)					Yearly Average	Runoff - (1000 Acre-Ft)			
				Max.	Date	Min.	Date	Average		Max.	Date	Min.	Date
1. Birch Creek	600 ft. downstream from Swift Dam	75.3	1	5,275	6/21/16	no flow	1/3/20	148	16	203	1916	55	1919
2. Birch Creek	8 mi. northwest of Dupuyer	105	1	*	6/ 6/08	3	4/9/37	159	30	230	1908	33.1	1931
3. Birch Creek	7 mi. northwest of Dupuyer	111	1	1,340	6/15/24	no flow	at times	*	*	*	*	*	*
4. Birch Creek	8 mi. northwest of Dupuyer	122	1	*	6/21/16	1	5/3/14	*	*	*	*	*	*
5. Birch Creek	10 mi. north of Dupuyer	128	1	*	6/21/16	no flow	at times	*	*	*	*	*	*
6. Dupuyer Creek	At Dupuyer	65.7	1	1,080	6/ 5/08	1.8	9/3/10	*	*	*	*	*	*
7. Dupuyer Creek	8 mi. southwest of Valier	137	1	3,330	6/ 7/34	no flow	at times	*	*	109	1927	6.07	1931
8. Dry Fork Marias R.	6½ mi. south east of Valier	131	1	*	*	no flow	at times	*	*	15.8	1912	2.08	1914
9. Dry Fork Marias R.	5 mi. upstream from mouth	314		1,220	5/31/27	no flow	at times	23.8	5	52.1	1927	5.73	1931

Source: "Water Resources Survey" Pondera County, Montana
Montana Water Resources Board, Helena, Montana, 1964

*Not Recorded

Note: Irrigation diversions occur above these stations

Two reservoirs in the county add significantly to the irrigation facilities. The largest is Lake Frances located near Valier. The reservoir has a usable capacity of 112,000 acre-feet. Water from the reservoir is used for irrigation in the Dupuyer and Birch Creek drainages. A second reservoir is the Swift Reservoir located seventeen miles west of Dupuyer. The usable capacity is 30,000 acre-feet. Water stored in the Swift Reservoir is used for irrigation in the Upper Birch Creek drainages.

The climate of Pondera County varies considerably from one area to another because of the wide range of topographic conditions. The effect that the topography has on the climate is very important to the water resources of the county. Prevailing west to southwest wind flowing across the high mountains in the western part of the county provides the highest annual precipitation values, nearly forty to fifty inches. Average annual precipitation values at the lower elevations in eastern Pondera County range between twelve and thirteen inches.

In general, precipitation occurs as steady rains in the spring months of April through June, as intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. Snow does not tend to remain on the ground in the lower elevations of the county due to "chinook" wind conditions and frequent winter warming spells. Snow does accumulate in November in the higher mountain valleys, however, and continues to build up until late March or early April. Portions of the high mountain snowpack in Pondera County and in other adjacent drainage areas remain until the warm temperatures of late July and August begin to melt them. Runoff from the snowpack at this time of the year coincides with the period of maximum demand for water in the valleys below.

Use of surface water in Pondera County is widespread for domestic, industrial, agricultural, and recreational purposes. The communities of Brady and Conrad draw upon surface-water resources for domestic purposes. Agricultural uses of water predominate. Over 124,000 acres are presently being irrigated, and existing facilities can handle an additional 13,000 acres. Another important use of surface water is for recreational purposes. The mountain lakes and streams in the county are ideal habitat for fish and waterfowl and draw many fishermen, hunters, and campers to the area each year.

As is the case in most counties in Montana, water appropriated for use in Pondera County far exceeds the amount available. Only a few minor streams in the county have decreed rights. An example of this inequity is the comparison of the average flow of the Dry Fork of the Marias River with the appropriation for the stream and its tributaries. The appropriation on record as of 1964 was 1,786.50 cubic feet per second (cfs). As shown in Table 6, the average flow of the river five miles above its mouth for a five year period was 23.8 cfs.

WATER USE CLASSIFICATIONS

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages in Pondera County and adjacent areas have been classified as follows:

Marias River Drainage except tributaries listed below:	B–D$_2$
Cut Bank Creek Drainage to, but excluding, Old Maid Coulee in Cut Bank except the portion of Willow Creek listed below	B–D$_1$
Willow Creek Drainage to the Montana Highway 464 crossing about one-half mile north of Browning	B–D$_1$
Willow Creek (mainstem) from the Montana Highway No. 464 crossing to Cut Bank Creek (also included in the Marias River Drainage classification above) .	B–D$_2$
Tributaries (if any) to Willow Creek from the Montana 464 crossing to Cut Bank Creek	B–D$_1$
Cut Bank Creek (mainstem) from Old Maid Miller Coulee to Birch Creek (also listed under Marias above)	B–D$_2$
Tributaries to Cut Bank Creek from, but excluding Old Maid Miller Coulee (which is "B–D$_2$" to Birch Creek)	B–D$_1$
Birch Creek Drainage except tributaries listed below:	B–D$_2$
Two Medicine Creek Drainage to and including the Badger Creek Drainage	B–D$_1$
Midvale Creek Drainage to the East Glacier water supply intake	A–Closed
Remainder of Midvale Creek Drainages	B–D$_1$
Summit Creek Drainage to the Summit water supply intake	A–Closed
Remainder of Summit Creek Drainage	B–D$_1$
Two Medicine Creek (mainstem) from Badger Creek to Birch Creek	B–D$_2$
Tributaries to Two Medicine Creek from Badger Creek to Cut Bank Creek	B–D$_1$
Teton River Drainage to and including Deep Creek near Choteau	B–D$_1$
Remainder of Teton River Drainage	B–D$_2$

GROUND-WATER RESOURCES

Ground-water aquifers are present in much of Pondera County at shallow depths and are widely used in the central and eastern parts of the county to provide water for stock and domestic purposes. As of January 1970, 287 well and fifty seven spring appropriations were on file with the Montana Bureau of Mines and Geology. Over ninety two percent of the wells and ninety percent of the springs are used for domestic and stock purposes. There is little ground-water data available for this area, and there are no published technical reports on the ground-water resources of the county. The only town or community in the county reportedly using ground water as a municipal supply is Valier.

From the rugged mountains in the west to the rolling plains in the central and eastern parts of the county, there is a wide variety of geological formations that range in age from Cambrian to Recent. In the geological past in this area there were long periods of sedimentation and erosion, punctuated by periods of upheaval and structural deformation. Continental and local alpine glaciation altered the landscape during the Pleistocene epoch (less than one million years ago) and left widespread deposits. The present availability of ground water is closely linked to the geological setting of the area.

The mountains of western Pondera County are composed of sedimentary rocks that range in age from Cambrian (less than 600 million years old) to Cretaceous (less than 135 million years old). These rocks have diverse lithologies, including limestone, dolomite, sandstone, and shale and show considerable structural deformation. Few if any wells are present in this area, but it is reasonably certain that many of the formations contain ground water.

Eastward from the mountains is a five to ten mile wide belt of severely faulted and folded rocks of Cretaceous age. Most of the rocks are part of the Montana Group which is comprised of Horsethief Sandstone, Bearpaw Shale, and Two Medicine Formation. Much of this area is covered by glacial material deposited by local glaciers moving eastward from the mountains. Information on the water-bearing characteristics of these disturbed formations is meager, and few wells are present in this area. The Horsethief Sandstone and the lower part of the underlying Two Medicine Formation are sandstones and should yield small to moderate quantities of water to wells.

In the geological past sedimentary rocks in the central and eastern parts of Pondera County were uplifted, forming a broad arch called the Sweetgrass Arch. After uplift, erosion slowly reduced the area to a plain. The Two Medicine Formation and underlying Virgelle Sandstone were completely removed over much of the arch. Similarly, much of the Colorado Group which underlies the Virgelle was removed. Long after uplift and erosion, glacial material was deposited over much of the bedrock by continental ice sheets. In the central part of the county, along the western flank of the Sweetgrass Arch, Virgelle Sandstone and Two Medicine Formation immediately underlie the glacial deposits and are used as a source of water. The Two Medicine formation is a greenish-gray clay, shale, and sandstone, with sandstone becoming abundant in the lower 250 feet. The formation has a total thickness of about two thousand feet, but erosion has removed much of the formation. The sandstone zone of the Two Medicine will yield small to moderate quantities of water to wells. The Virgelle Sandstone consists of two hundred to three hundred feet of massive sandstone and will yield moderate quantities of water to wells.

In the eastern part of the county along the Sweetgrass Arch, the Colorado Group is the first bedrock formation encountered beneath the glacial deposits. The Colorado Group is a dark gray shale approximately fifteen hundred to two thousand feet thick; however, erosion has reduced the thickness to a few hundred feet over much of the area. The Colorado Group thickens westward, and a few miles east of Valier the entire thickness is present. The Colorado Group is a poor aquifer (water-bearing formation) and is little used in the county, but it may contain occasional sandy layers that will yield water.

Beneath the Colorado Group are a number of sedimentary formations that contain ground water; however, the water is generally of a poor quality and, except for secondary oil recovery, has limited usefulness.

Glacial materials deposited by Pleistocene glaciers include terminal and ground morains, outwash channels, and lake sediments. The morainal deposits consist of a compacted mixture of boulders, sand, gravel, silt, and clay that range in thickness from a few feet to over eighty feet. These deposits generally will yield small quantities of water to wells, but the water-yielding properties vary widely from place to place. Many wells encounter a water-bearing zone near the bottom of the morainal deposits which contains sand and gravel and is probably a pre-glacial alluvial surface. Outwash channels filled with sand and gravel are found in the morainal deposits and will usually supply moderate to large quantities of water to wells. During the glacial period streams were blocked by ice sheets and large glacial lakes formed. Lake deposits are present west of Valier along Birch Creek in central Pondera County. These deposits consist of fine-grained silt, clay, and sand. Few wells are drilled into the lake sediments, but it is thought that sandy zones in the sediments will yield small quantities of ground water.

Glacial deposits, derived from alpine glaciers that advanced eastward from the mountains, cover a sizeable area in the western part of the county. Little is known of the ground-water potential of these deposits, but alpine glacial debris should contain sand and gravel zones that would yield small to moderate quantities of water to wells.

In addition to bedrock and glacial deposits, there are old terrace deposits in western Pondera County and minor Recent alluvial deposits along area streams. These deposits may yield small, and in a few locations moderate, quantities of water to wells.

Little water quality information is available for the county. Chemical analysis of water from wells in the town of Valier shows the water to be of fair quality. The water is from the Two Medicine Formation, is hard and contains considerable dissolved calcium, magnesium, bicarbonate, and sulfate. Generally, water quality should be fair where bedrock aquifers are recharged by precipitation, but, as the distance to the recharge areas increases, water quality becomes poorer. Formations present beneath the Colorado Group probably contain very poor quality water. (See Table 7 for chemical analysis of municipal water supplies in Pondera County and see Table A in Appendix I for accepted water quality standards.)

The ground-water resources of Pondera County are not well known and not widely developed. Ground water is generally available in small moderate quantities, but the quality ranges from good to very poor. Continued development of ground water for stock and domestic purposes, and to a lesser extent for irrigation and industrial use, can be expected; however, future development of ground water will require detailed hydrogeological investigations to obtain adequate yields from wells and suitable water quality.

Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
2. State Department of Health, Helena, Montana
3. "Water Resources Survey" Pondera County, Montana, Montana Water Resources Board, Helena, Montana, 1964

TABLE 7

Chemical Analysis of Municipal Water Supplies (All Figures in Milligrams per Liter) *

City or town	Brady	Conrad	Valier	Valier	Valier
Source	Irrigation Ditch	Lake Frances	Well No 1	Well No 2	Well No 3
Date	8/67	8/67	7/69	7/69	7/69
Total Solids	1080	194	626	632	574
Hardness	568	145	390	380	340
Ca	66	27	52	64	48
Mg	98	19	63	54	54
Na+K	134	26	74	87	91
CO_3	12	18	0	0	0
HCO_3	293	152	378	396	353
SO_4	521	31	207	188	194
Cl	29	9	18	19	19
NO_3	2	0	2.1	3.6	2
F	0.82	0.18	0.54	0.50	0.42
Fe	0.0	0.3	0.00	0.00	0.00
As	0.002	0.001	0.00	0.00	0.00
Pb	-	-	0.00	0.00	0.00
Cu	-	-	0.00	0.00	0.00
Zn	-	-	0.00	0.00	0.00

*See Appendix I, Table A, for accepted water quality standards
Source: State Department of Health, Helena, Montana

THE SOILS

GENERAL

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Pondera County has an interesting and quite complicated geologic history which has greatly influenced the soil structure of the area. The dominating geological features of the county are the mountainous areas along the western county line. As a result of the advance and recession of glaciers in the area, much of Pondera County is covered by glacial till. Also, extensive drainage from the mountains has resulted in the filling of many stream valleys with alluvial gravels. The soils of Pondera County are made up of alterations of the parent materials due to various conditions of climate, topography, and living organisms.

It has been determined that the soils of Pondera County fall in the category of approximately seven Great Soils Groups as outlined in the pedological system of soil classification. These groups include Alluvial, Brown, Chestnut, Chernozem, Solodized-Solonetz, Gray Wooded, and Grumosols.

Alluvial soils are young soils found along streams and valley floors. The material has undergone little or no modification except for a slight accumulation of organic matter in the surface.

Brown, Chestnut, and Chernozem soils are formed under conditions of relatively high precipitation and found in upland regions. These soils are characterized by a dark surface and a zone of lime accumulation extending beneath the surface soil.

Solodized-Solonetz soils usually have thin platy surface soils underlain by a dark layer of hard clay which is usually alkaline. Spots of this soil within areas of Chestnut or Brown Soils will usually produce stunted plant growth.

Grumosols are characterized by a high clay content and because of this they are extremely plastic when wet. This soil has a very dark surface which tends to crack and become extremely hard upon drying.

Gray Wooded Soils occur primarily in mountainous regions. Mean annual precipitation values range from twelve to twenty five inches in areas where these soils are found.

SOIL MAP

The Soil Conservation Service of the United States Department of Agriculture has prepared a general soils map for Pondera County. The soils map as presented by them is shown as Map 4 in this report. In developing this map, the Soil Conservation Service made field studies and observations which resulted in the delineation of eleven general soil areas. Each general soil area as a rule contains a few major soils and several minor soils. Soils within an area may differ greatly in short distances and any one soil may occur in more than one area. Thus, the general soils map does not show the kind of soil at any particular point but rather shows specific patterns of soils.

The Soil Conservation Service preliminary draft descriptions of the eleven soil areas shown on Map 7 are as follows and coincide with numbers on the soils map:

1. Area dominated by moderately deep and shallow, well drained, moderately dark colored loam and clay loam soils on rolling to steep shale and sandstone uplands. Soils on nearly level to sloping high outwash fans and terraces are included.

2. Area dominated by deep, well drained, moderate dark colored loam and gravelly loam soils on nearly level to gently undulating outwash terraces.

3. Areas dominated by deep, well drained, moderately dark and light colored clay soils on nearly level to undulating glacial till and glacial meltwater deposits.

4. Areas dominated by deep, well drained, dark and moderately dark colored loam and silty clay loam soils on nearly level to undulating glacial meltwater deposits.

5. Areas dominated by deep, well drained, moderately dark and light colored loam and clay soils on nearly level to rolling glacial till and glacial meltwater deposits.

6. Areas dominated by rough broken lands, consisting of shallow clay soils over shale and light colored calcareous glacial till soils. Outcrops of shale or sandstone are scattered throughout the area.

7. Areas dominated by deep, well drained, moderately dark and light colored sandy loam and loamy sandsoils on nearly level to rolling glacial meltwater and wind reworked deposits.

8. Areas dominated by saline and alkali soils on nearly level terraces and in undrained basins.

9. Areas dominated by shallow, well drained, moderately dark colored loam and clay loam soils on nearly level to rolling shale and sandstone uplands and deep, well drained loam and gravelly loam soils on nearly level to undulating owtwash benches.

10. Areas dominated by deep and moderately deep, well drained light and dark colored stony soils on steep foothills.

11. Areas dominated by moderately deep and very shallow stony soils and igneous and limestone rock outcrops of the mountains.

CONCLUSIONS

The soils of Pondera County have generally been easy to deal with where shallow domestic water wells and individual sewage drain fields have been constructed. The large amounts of glacial till and alluvial gravels have been found to be extremely variable in permeability, however. This has had an affect on both the quantity of water available in shallow domestic wells and on the successful operation of individual sewage drain fields. In areas of extensive clay and silt deposits even more care must be taken in the construction of septic tank drain fields.

Construction of water and sewer systems in the various soils of Pondera County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse stream gravels slow operations somewhat. Some bedrock has been encountered at normal water and sewer line installation depths.

Sources:
1. U. S. Department of Agriculture, Soil Conservation Service, Conrad, Montana
2. "Water Resources Survey" Pondera County, Montana, Montana Water Resources Board, 1964

COMMUNITY WATER SYSTEM FACILITIES

GENERAL

This comprehensive report covers the overall problems, existing or projected, for Pondera County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the overall needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically the demand for sufficient water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities, a system with capacity enough to give high ratings for fire protection would require a system considerably larger than necessary for domestic purposes and one that the community might be unable to finance. The approach in such cases has been to propose a system suitable for present domestic needs. These basic facilities can then be expanded for more complete service and for higher ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water usage for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

BASIC CONSIDERATIONS

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits, the type of water facilities available was examined and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities, the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths. For such situations, private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities, population is increasing and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the residents now with provisions for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

PONDERA COUNTY

The estimated 1970 population of Pondera County is eight thousand. Approximately 3,900, or forty nine percent, of these people are presently served by a central water system, and the remainder are served by such private facilities as wells and springs. If the schedule of proposed improvements outlined in this report is followed, about 4,485, or fifty eight percent, of the estimated population, will have access to central water systems by 1980. It is expected that the remaining forty two percent will live in the outlying areas and the homes will not be close enough together to make central systems feasible.

CONRAD

Existing System. The 1970 population for Conrad and the fringe area is 2,975. The community is expected to show a slight population increase throughout the planning period. The area presently served by the community water system is shown on Map 5. The estimated number of persons in this area is 2,800.

The supply of water for their system is obtained from Lake Frances located about fourteen miles northwest of the town. Water is transmitted from the lake to the town by means of a ten inch and a twelve inch gravity line. A two million gallon open reservoir is located three miles west of the city. Pumping facilities capable of producing sixteen hundred gallons per minute (gpm) are located at this reservoir and two twelve inch lines carry the water to the town. There is no present storage available in the town itself. The water obtained from this source has a high turbidity at certain times of the year. A filtration plant with a capacity of 560 gpm is used during the winter months to treat the water. This plant does not have adequate capacity to handle high demand during the summer months and will have to be expanded to have filtering facilities usable during the entire year. The existing distribution system is adequate for their needs.

Improvements Next Five to Ten Years. The population is expected to be 3,115 by 1975. The supply line and distribution system as they now exist are considered to be adequate during this period. It is proposed that a water treatment plant be constructed during this period. This facility should have a capacity of sixteen hundred gpm which would treat all water used by the town. The location of the treatment plant should be determined by a detailed study. Expansion of the present plant facilities may be feasible or the facilities could be constructed at the site of the present surface storage ponds. Covered storage facilities are considered to be a necessary improvement to this system. A 600,000 gallon elevated storage tank is proposed as shown on Map 5.

Improvements by 1990. The estimated 1990 population is 3,625. The present water system and the proposed improvements during the coming five to ten years will result in a system which will be adequate throughout the planning period. Some expansion of the distribution system may be necessary to take in new service areas.

VALIER

Existing System. The 1970 population is 722. Population projections indicate the community will lose about fifty residents during the planning period. The town presently operates a community water system. The water supply is obtained from three wells with a combined capacity of 105 gpm. Storage consists of an elevated 55,000 gallon storage tank. The existing distribution system is adequate for their needs.

Some shortage of water is experienced during the high demand periods of the summer months. The system analysis indicates that the present water supply will result in about 225 gallons of water being available to each user per day. This is somewhat less than the averages of other communities within the state; it is, however, an acceptable amount. An additional water supply could be developed and it is proposed that this be done. The present wells produce a very hard water and it is reasonable to expect that the same type of water would be obtained from additional wells. Therefore, it may be more suitable to develop a water supply from Lake Frances.

Improvements Next Five to Ten Years. The population is expected to be 712 by 1975. It is proposed that a detailed study be conducted in order that the best method for obtaining additional water supply be determined. Additional wells, as shown on Map 6, could be one consideration and an infiltration gallery near Lake Frances should also be studied. Additional wells, as proposed in this study, are the most economical solution. An infiltration gallery could be an alternate source. If properly developed, it is expected that a better quality water and a larger quantity of water would be obtainable from this source. The storage facilities presently in existence are not adequate for this population. An additional 100,000 gallons is proposed.

Improvements by 1990. The population is expected to be 675 by 1990. The present system together with the proposed improvements during the five to ten year period will result in a system which will adequately serve the needs throughout the planning period.

BRADY

Existing System. The 1970 population is 225. The population is expected to remain essentially steady throughout the planning period. A water distribution system is presently in existence and is shown on Map 7. The supply of water for this system is obtained from an irrigation ditch near the city. A five million gallon surface storage reservoir, located just west of the city, is necessary to hold sufficient water supply for the winter months. The growth of algae in this reservoir causes a taste and odor problem during certain times of the year. However, this source of supply is considered to be the best obtainable for the community. A water treatment plant would greatly improve the quality of water available to the users. This facility could feasibly be constructed at the storage reservoir. A pump house containing two 150 pumps is located at the reservoir. A six inch supply line carries water to the distribution system. Storage consists of a 40,000 gallon elevated storage tank located in the community. The distribution system is adequate for the needs.

Improvements Next Five to Ten Years. Population is expected to be 220 by 1975. The only improvement that is considered to be necessary for this system is the development of a water treatment plant. This would result in a uniform quality of water and the facility is feasible. An additional storage reservoir is also proposed so that a more uniform supply of water is available to the community. This would result in an alternate operation being possible when one of the reservoirs is shut down for maintenance.

Improvements by 1990. The population is expected to be 215 by 1990. The present system together with the improvements proposed under the five to ten year plan will result in a system which is adequate for their needs throughout this period.

DUPUYER

Existing System. The estimated 1970 population is 120. The residents presently obtain their water supply from private wells. Most wells in the community produce good quality water; however, one area of the town does have a taste problem. There are adequate quantities of water available. The wells are for the most part under twenty five feet in depth. Some question arises as to the possibility of these wells becoming contaminated since the sewage effluent from the septic tanks discharges into the gravelly soil from which the water supply is obtained. This is an undesirable situation and one which is possible to remedy.

Improvements Next Five to Ten Years. The population is expected to decrease to 115 by 1975. This is believed to be due in part to the lack of community water facilities. A water system is feasible and a proposed layout is shown on Map 8. A well capable of producing seventy gpm could be readily developed. Storage facilities in the amount of forty thousand gallons is considered to be adequate for their needs.

Improvements by 1990. The projected population for 1990 is one hundred. It is expected that this figure would be somewhat larger if a community water system was in existence. The system as proposed under the five to ten year plan would be adequate to serve their needs throughout the planning period.

HEART BUTTE

Existing System. Most of the 175 residents of this community presently obtain their water supply from private wells, while some residents carry their water from other available sources. An excellent quality of water is obtainable at about 125 feet in depth. Adequate quantities are also obtainable for a community water system which is feasible and is proposed.

Improvements Next Five to Ten Years. The estimated 1975 population is 175. A community water system is proposed during this period. A well capable of producing one hundred gpm could be readily developed. A forty thousand gallon storage facility would be adequate for their needs. The proposed system is shown on Map 9. The homes are spread over a wide area which would result in a rather high total project cost. The lack of present adequate water systems and the large number of persons which would benefit by this facility are factors which are considered to make the project feasible.

LEDGER

Existing System. The population of this community is seventeen. Population is expected to remain essentially steady throughout the planning period. Residents of this community haul their water from Conrad because local wells produce a water with a high alkali content not considered to be suitable for human consumption. Conrad, the nearest known suitable water source, is about ten miles away. The small population does not warrant the construction of a pipeline to this source. The most suitable source of water supply for the residents of this community will continue to be the hauling of water on an individual basis from Conrad.

COMMUNITY SEWER SYSTEM FACILITIES

GENERAL

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes is an important and necessary use of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes, if discharged into water courses, can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution, by definition and interpretation, is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy, established by the state legislature, to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act, in reference to pollution abatement, gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria", "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, or animal and agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration in this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in the "Analysis Criteria" in Appendix III, will suffice in practically all cases.

BASIC CONSIDERATIONS

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial waste shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

PONDERA COUNTY

Approximately 3,920 people, or forty nine percent of the Pondera County population, are presently served by community sewage facilities. The proposed expansion program outlined in this report would result in about 4,780, or sixty five percent of the 1990 population, having access to community facilities. The remaining thirty five percent will live in outlying areas and the homes will not be close enough together to make community systems feasible.

CONRAD

Existing System. The estimated 1970 population for the town and the fringe area is 2,975. A community sewer system facility presently serves about 2,800 persons. The collection system could be expanded to serve all of the fringe area as well. The collection system has adequate capacity for present sewage flows. An eighteen inch outfall line carries the sewage to a twenty two acre wastewater stabilization pond located north of the town.

Improvements Next Five to Ten Years. By 1975 the population is expected to be 3,115. The present sewage collection system can be expanded to serve the needs of this population. Expansion of the present sewage treatment facility will also be necessary by this time. A ten acre addition to the present wastewater stabilization pond is proposed by 1975.

Improvements by 1990. The estimated 1990 population is 3,625. The present collection system will be adequate for their needs during this period; however, some expansion to serve new areas will be necessary. By 1990 it is proposed that a five acre addition be made to the present wastewater stabilization pond. This enlargement together with the expansion during the five to ten year period will result in a total area of thirty seven acres which will be adequate for the estimated 1990 population.

VALIER

Existing System. The estimated 1970 population is 722. A community sewer system facility is presently in existence and a layout is shown on Map 12. Sewage treatment is provided by a fourteen acre wastewater stabilization pond located north of the town. A twelve inch outfall line carries sewage to this pond. The capacity of the collection system, outfall line, and treatment facility is adequate for their needs.

Improvements by 1990. The estimated 1990 population is 675. The community sewer facility as it presently exists will be adequate for their needs throughout this period.

BRADY

Existing System. The estimated 1970 population is 225. A community sewer system facility is presently available to all residents of the community. The system consists of a collection network of eight inch pipe and a ten inch outfall line to a wastewater stabilization pond north of the city. This stabilization pond is 2.75 acres. The existing system adequately serves the needs of the present population. The overflow from the existing stabilization pond is discharged into a road ditch where effluent evaporates or soaks into the soil. It is recommended that additional pond surface area be provided so that evaporation will be greater or that the overflow from the present pond be used for irrigation or otherwise distributed over a larger area of ground.

Improvements Next Five to Ten Years. Population is expected to be 220 by 1975. The present system is considered to be adequate for their needs during this period. A two acre addition to the present wastewater stabilization pond is proposed so that a longer holding time is possible.

Improvements by 1990. The estimated 1990 population is 215. The present system together with the proposed improvements during the five to ten year period will result in a system which is adequate for their needs.

DUPUYER

Existing System. The estimated 1970 population is 120. These residents presently use private septic tanks and cesspools for sewage disposal. There is a rather high water table; however, the septic tanks apparently function satisfactorily. The top layer of the soil is a clay material. Below this layer, the soil is gravelly and readily accepts sewage effluent. When septic tank drainfields are constructed to discharge into this gravel layer the overflow water drains away readily, resulting in a properly operating system.

There is some concern that effluent from these septic tanks is being discharged into the water bearing strata from which they are obtaining their water supply. A community sewer system is proposed to eliminate this potential health hazard. Also there is sufficient population to justify the facility.

Improvements Next Five to Ten Years. Population is expected to be 115 by 1975. A community sewer system facility is proposed and is shown on Map 14. The facility should not be difficult to construct if trenching depths are kept shallow.

Improvements by 1990. The population is expected to be one hundred by 1990. It is felt that this figure could be considerably higher if adequate sanitary facilities were constructed. The system as proposed under the five to ten year plan would be adequate for their needs throughout the planning period.

HEART BUTTE

Existing System. The 1970 population is 175. Sewage treatment is currently handled by means of private septic tanks; however, many pit privies are in existence as well. Some areas of the community have a gravelly soil which readily accepts sewage overflows. Other areas have a problem with the operation of drainfields where less porous soils which do not accept sewage effluent are found. The homes are presently spread over a rather large area making the cost of a community sewer system facility high. The present lack of adequate sanitary facilities and the number of persons involved make a system both necessary and feasible.

Improvements Next Five to Ten Years. The estimated 1975 population is 175. A community sewer system is proposed and a layout is shown on Map 15. The system, while desirable and necessary, would be expensive to construct.

Improvements by 1990. The population is expected to be 165 by 1990. The system as proposed under the five to ten year plan will be adequate throughout the planning period.

LEDGER

Existing System. The estimated 1970 population is seventeen. This population is expected to remain steady throughout the planning period. Private septic tanks provide sewage treatment in the community. The soil is sandy and provides good drainage for the septic tank overflows. These facilities are considered to be adequate for their needs throughout the planning period.

TETON COUNTY

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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

CONCLUSIONS

The total population of Teton County is expected to decline during the planning period. The population decrease is expected to take place primarily in the rural farm areas of the county. The larger communities such as Choteau, Dutton, Fairfield, and Power will show increased population through 1990.

The existing community water and sewer systems are generally considered to be in rather good condition; however, some improvements are considered to be necessary for practically all of the systems. Power does not have a community sewer or water system at this time; however, a system is feasible and could be constructed. The smaller communities of Bynum and Pendroy could feasibly construct community water system facilities since the systems could be constructed quite economically. Generally, those persons residing within the corporate boundaries of the cities have access to the community system, but the developments adjacent to these boundaries do not. It is feasible for the present systems to be expanded to provide service to these areas and it is proposed that this be done.

It is the intent of this plan to show where enlargement of these facilities may be necessary to accomplish this. Layouts for new systems have been proposed where population is expected to increase or where sufficient demand now exists to make these systems feasible.

RECOMMENDATIONS

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P. O. Box 850
Bozeman, Montana 59715

Federal Water Pollution Control Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health,
Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and
Urban Development
Assistant Regional Administrator
Region VI Northwest Area Office
197 New Customs House
721 19th Street
Denver, Colorado 80904

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

PRIORITIES

That a particular system requires immediate improvements and another system will be satisfactory for a definite period is difficult to establish. But several indicators for establishing priorities are available. The general health of the people is the prime consideration and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefiting by any improvement must also be considered. These basic criteria were used in establishing the following priority listings:

1. **Choteau Water System.** The total number of persons which would benefit from the increased water supply make this project very important. The improvement is necessary and could be developed quite economically.

2. **Dutton Sewer System.** The elimination of a potential pollution problem make this project very necessary.

3. **Power Water System.** The community has sufficient population to justify a community water system. The project is feasible and necessary.

4. **Dutton Water System.** The present taste problem associated with the growth of algae in their storage reservoir makes the construction of water treatment facilities necessary. The number of persons which would benefit from this improvement make the proposal feasible.

5. **Fairfield Water System.** The number of persons who would benefit from increased water supply and the need for a constant source of supply being available, make the project feasible.

6. **Bynum Water System.** The present lack of an adequate safe water system make this project very necessary. The number of persons who would benefit make the project feasible.

7. **Pendroy Water System.** The present lack of an adequate and safe water system make this project both feasible and necessary.

8. **Choteau Sewer System.** The elimination of a potential health hazard and pollution problem makes this project feasible and necessary.

9. **Power Sewer System.** The problems which are experienced with the present use of septic tanks and the number of persons which would benefit from a community system make the project feasible and necessary.

This list of priorities is not intended to govern the order in which action should be taken. The order merely ranks the severity of the problems and the need for improvements.

THE LAND

GENERAL CHARACTERISTICS

Teton County is located in the northwest section of Montana and lies roughly in the area between the Continental Divide and Great Falls. Bounded by the counties of Pondera, Chouteau, Cascade, Lewis and Clark, and Flathead, Teton County contains 2,294 square miles of land and sixteen square miles of surface water. The majority of this water surface area is contained in Pishkun Reservoir and Freezeout Lake in the southern half of the county and in Bynum Reservoir in the northern half of the county.

The topography of the county, as indicated on Map 1, is characterized by flat lands in the east, rolling hills in the middle portions, and rugged mountains that rise in the western edge of the county to meet the Continental Divide. Elevations vary from nine thousand feet above sea level in the west along the mountain ridges to 3,400 feet in the east where the Teton River flows eastward into Chouteau County. All of the towns and the majority of the population are distributed throughout the eastern two thirds of the county. Choteau, the largest town and the county seat, is located in almost the exact center of the county.

Teton County is served by three federal highways and numerous state and county secondary roads. U. S. Highway 91 crosses the eastern portion of the county and leads to Great Falls in the south and to Conrad and Shelby in the north. U. S. Highway 89 roughly divides the county and runs in a southeast to northwest direction. Branching off from U. S. 89 at Choteau, U. S. Highway 287 leads into Lewis and Clark County to the southwest. Many unpaved roads serve the outlying areas of the county.

Rail service in Teton County is provided by the main line of the Burlington-Northern Railroad. This rail line forks near the community of Power in the southeast corner of the county; one fork continues on through the county to Conrad and Shelby in the north, and the other fork stretches westward to Choteau and then north to the community of Pendroy where it terminates. The Chicago, Milwaukee, St. Paul and Pacific Railroad also serves Teton County. Passing through Great Falls, this rail line enters the county in the southeast area and, serving Choteau, terminates near the northern county border at Agawam.

Although there are no commercial aircraft landing fields in Teton County, a paved landing field is available for public use at Choteau; no services are, however, available. Unpaved landing fields are also located at Dutton in the eastern part of the county and at Fairfield in the southern county area. Daily air services and connections to nation wide airlines are available at Great Falls in nearby Cascade County.

Teton County is served by the Great Falls Division of the Montana Power Company. Service is distributed from hydroelectric generating stations in Great Falls in a loop that extends up through Dutton to Conrad in Pondera County and back down through Choteau and Fairfield. A power transmission line administered by the Rural Electric Administration branches off from the Montana Power Company line near Fairfield and serves an area in the extreme southern regions of the county.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana.

Telephone service in Teton County is provided by the Mountain States Telephone Company and the Three Rivers Telephone Cooperative. Mountain States Telephone serves the communities and surrounding areas of Choteau and Dutton. The area around and including Pendroy and the southern and eastern parts of the county are served by the Three Rivers Telephone Cooperative.

LAND OWNERSHIP AND USE

The largest share of the land area in Teton County, 1,072,640 acres, is privately owned. Federal government lands, mostly in wilderness areas and national forests, account for 313,600 acres. The remaining 102,400 acres are owned by the State of Montana. The geographical locations of the various ownerships are shown on Map 2.

Land use in the county is reflected to a great degree in the general characteristics of the topography. The largest share of the county's area, made up of rolling hills and plains, is used for agricultural purposes. The western edge of the county, consisting of rugged mountainous areas, is the location of the sixteen percent of the land in forests. The sixteen square miles of water surface area account for less than one percent of the county's land. Land area used for such miscellaneous purposes as townsites and transportation routes are included in the above general categories. Charts 1 and 2 graphically indicate land ownership and use.

NATURAL RESOURCES

Oil was discovered in what was to become Pondera Field in the border area shared by Teton and Pondera Counties in 1927. In 1968 this two county field produced 324,570 barrels of oil and averaged a daily output of 887 barrels. The Genou Oil Company discovered oil in the northeast section of the county in 1927 also. This oil producing area was named Bannatyne Field and produced 15,568 barrels of oil in 1960. Pondera Field appears to have the most promising future and will probably continue as an important oil producing center for Montana.

Natural gas was discovered in the northwest area of the county in 1958 and was for a time producing up to 3.3 million cubic feet of gas per day. This field, called Blackleaf Canyon Gas Field, has since closed down operations.

There were four wildcat wells drilled in Teton County in 1968; all of them, however, were dry.

Coal occurs in the county as part of a belt that stretches from Cascade County to the south, north through Teton, Pondera, and Glacier Counties and on into Canada. The belt ranges from six to sixteen miles wide and consists of high volatile bituminous rank coal. Commercial operations, however, are not economically feasible at this time in Teton County as steeply dipping strata, together with thrust faults, carry the coal below minable depths within short distances from the surface outcrops.

Stone, sand, and gravel operations complete the mining picture for the county.

In the future mining, operations in the county will probably remain at a low level until that time when the demand justifies the necessary capital outlay for additional mining operations.

Of the 269,826 acres of forested land in Teton County, 189,925 acres are classified as commercial timber. These forests are, however, entirely on national forest lands and, consequently, there are no commercial lumbering operations in the county and the timber industry is entirely dependent on the United States Forest Service for its logging operations. Logging is also hindered by the rugged physical characteristics of the area and by the sporadic locations of the various types of timber. There are approximately ten species of trees in the area, the most common of which are larch, Douglas fir, spruce, Ponderosa pine, and white pine. These merchantable species often occur in narrow stringers or small pockets and, coupled with the rugged topography, make road costs extremely high.

Lumbering operations on these national forest lands yielded $3,036.09 to Teton County in 1969.

Recreational opportunities in Teton County are varied. The western portion of the county is covered by the forest and mountain areas that include part of the Lewis and Clark National Forest and a portion of the Bob Marshall Wilderness Area. Big game hunting in this area includes such prize species as moose, elk, white tail and mule deer, black and grizzly bear, big horn sheep, and Rocky Mountain goat. Antelope are found on the prairie areas. The forested areas also offer hiking and pack trails and many picnic and camping areas. Bird hunters can find such fine game species as pheasants, Hungarian partridge, grouse, and water fowl in almost any area of the state. In the more easterly areas of the county, such water surface areas as Bynum and Pishkun Reservoirs and Freezeout Lake offer such water related sports as boating and swimming. The North Fork of the Sun River, the Teton River, Dupuyer Creek and Deep Creek are just some of the many streams that offer fine rainbow and Cutthroat trout fishing. Split Rock Lake is a noted producer of prize northern pike.

The future potential of recreation in Teton County will in all likelihood expand with the expansion of the American public's leisure time.

WATER

As indicated earlier, less than one percent of the land area in the county is made up of water. The principle drainage system of the county is that of the Teton River which, along with its tributaries, drains most of the county area. In the extreme western part of Teton County, supplementary drainages are provided by the North Fork of the Sun River which flows south southeast out of the county and by the upper Dupuyer Creek which flows northeast into Lewis and Clark County.

Water resources are covered in more detail later in this report.

SOIL

There are many different types and classes of soils in Teton County and these diverse groups will be covered in detail later in this report. Briefly, however, the soils in the area can be placed in two wide categories. The extreme western edge of the county is mountainous and the alpine soils in that area support forests; in some areas, however, the soils are too stony to support any life at all. The soils of the rest of the county are agriculture supporting and range from grasslands in the higher bench areas to irrigated croplands in the lower elevations.

CHART 1

Land Ownership

Teton County

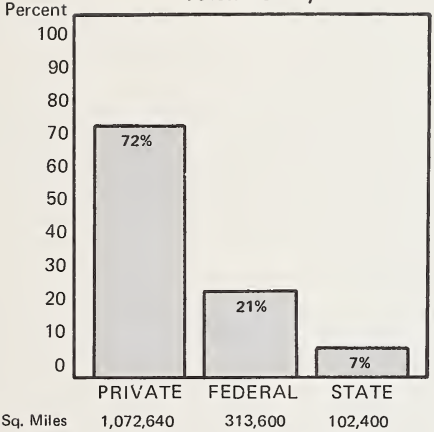
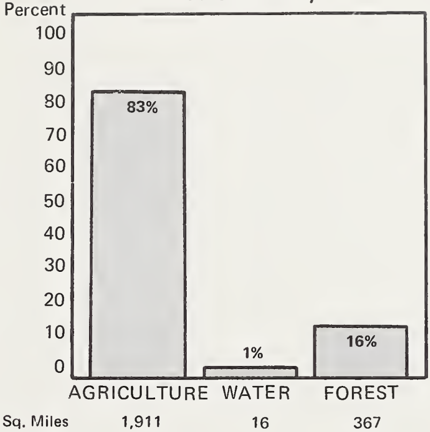


CHART 2

Land Use

Teton County



Source: The Montana Almanac 1959-60

THE PEOPLE

POPULATION

For analytical and projective purposes, it is useful to study the population history of Teton County to find out what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that of the State of Montana and indicates the future growth for both.

The population of the county experienced a slow growth from 1920 to 1950 and has leveled off since that year. During this period the state grew at a rate similar to that of Teton County, but since that time, the county's growth rate had increased and will continue to do so throughout the planning period.

The United States Bureau of the Census has classified Teton County as a peripheral metropolitan or suburban place in that it lies adjacent to a Standard Metropolitan Statistical Area. Table 1 indicates that since 1950 the urban population of the county experienced an average growth of thirteen percent for each ten year period. The majority of the population, however, still resides outside the urban areas of the county. The rural population can best be described as agriculturally oriented since more than eighty six percent live on farms. The rural non farm population has decreased by sixteen percent over the past twenty years while the farm population decreased more than twenty eight percent over the same period.

The county increased its population by sixty three during the period of 1950 to 1960. Chart 4 indicates that of the recorded change there was a net migration change of 1,109 and an excess of 1,172 births over deaths.

The change in sex composition for Teton County from

1950 to 1960 is shown in Chart 5. As shown, the number of both sexes had remained fairly even over the ten year period with a slight preponderance of males over females. Females are increasing in total number, however, and should outnumber the males in the not too distant future. The age distribution by sex for 1950 and 1960 is shown in Table 2. The largest population is noted for those people over forty five years of age, thus indicating a general out migration of the younger age persons.

A total of eight towns and communities have been studied for Teton County. The list includes the three incorporated towns of Choteau, Dutton, and Fairfield, and the five unincorporated communities of Bynum, Collins, Farmington, Pendroy, and Power.

Because of the time passed since the 1960 Census, current population estimates had to be derived from several sources in the field. Field surveys and interviews have been undertaken to determine what now exists and what is expected in the future. Table 2 indicates that past population experienced for the communities and the forecasts for the future.

Over the next twenty years Choteau will continue to grow and serve as the main population center for the county. During the same period the fringe area will experience a slow growth in terms of absolute population gain. The main growth in the town will be in the west while expansion of the fringe area will be to the north.

Fairfield is the second largest town in the county and is primarily agriculturally oriented. The population in the town will continue its slow steady growth as in the past, and the fringe area will grow at a somewhat more rapid rate. The growth in the town will be towards the southwest and the fringe growth will probably occur south of Highway 89.

With a present population of 525, Dutton is the third largest town in Teton County. It is located in the eastern part of the county on a branch line of the Burlington-Northern Railway. The area is considered to be one of the finest wheat raising districts in Montana. The population of Dutton is expected to remain stable over the next twenty years with a growth rate of less than five percent. The fringe area will also show some minor growth. Any growth that occurs will be in the southeast portion of the community.

With the exception of Power, the remaining communities are expected to experience a population decline by 1990. Power will increase by about twenty five persons over the next twenty years.

It should be mentioned that the population figures reflect only those factors and trends for which there is available information. New technological advances, new industries, and other unforeseen action may alter the population forecasts given. In case of such an event, the areas affected should be re-examined in the light of the new condition.

HOUSING

In 1960 there were 2,529 housing units in Teton County. Chart 6 indicates that almost two out of every three housing units were of the rural non farm type. The remaining units were farms. The median housing unit size was 4.60 rooms per unit and the median household size per occupied unit was 3.39 persons. Of those units, almost sixty percent were owner occupied while one in four were renter occupied. Chart 7 indicates that a substantial fifteen percent were vacant. The condition of housing in 1960 is reflected in Chart 8 which indicates that only four percent were in need of replacement while only sixteen percent needed repair. The remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of the source of water, water supply, and the method of sewage disposal. For geographical reference, the data shows the status for Teton County as a whole, and the rural non farm and farm areas.

In 1960 forty two percent of all the homes in the county were served by a public water system or by a private company. Those served included almost two out of every three rural non farm homes and only six percent of all farms. More housing units in the county used wells as their main source of water than were connected to a public or private water system in 1960. Understandably, wells were used as the primary source of water on the rural farms, but, at the same time, almost one third of all rural non farm housing units also relied on wells for their water supply. One home in seven in the county in 1960 used sources other than wells, public systems, or private companies for water. Those resorting to other water sources represented more than one fifth of the farm units and more than one tenth of the rural non farm housing units.

Only about one home in seven in the county did not have any piped water inside their home in 1960.

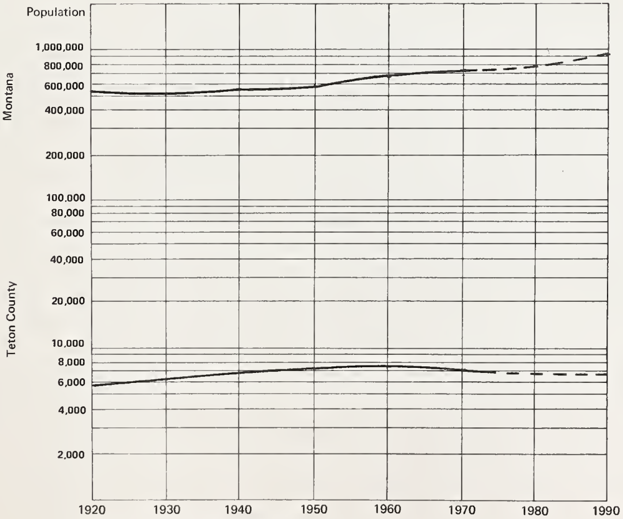
Less than half of all homes were connected to a public sewer in 1960 while more than one home in three used a septic tank or cesspool for sewage disposal. Almost one fifth of all homes used methods other than public sewers, septic tanks, or cesspools.

In terms of source of water, water supply, and sewage disposal, the rural non farm areas tend to be better serviced than the rest of the county. The population trends, both present and future, indicate that increases will occur in this rural non farm area. Planning studies for Teton County indicate that attention needs to be directed towards eliminating existing water and sewer deficiencies.

CHART 3

Comparative Population Trends

Teton County and Montana 1920-1990

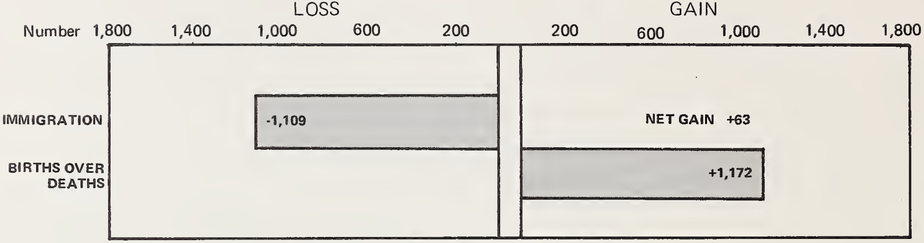


Sources: 1. U. S. Census of Population
2. Intermountain Planners, Inc.

CHART 4

Population Change

Teton County 1950-1960

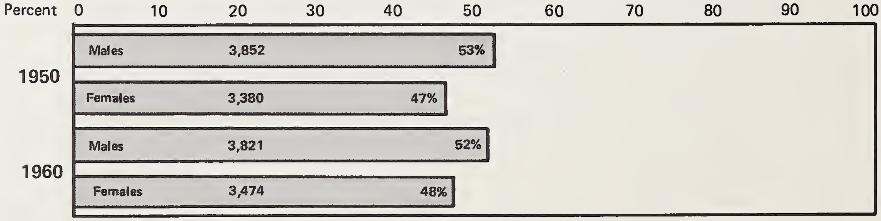


Source: Net Migration of Population, 1950-60 by Age, Sex and Color, U. S. Department of Agriculture

CHART 5

Population by Sex

Teton County 1950-1960



Source: U. S. Census of Population

TABLE 1

Urban-Rural Population Changes for Teton County 1950-1970

	1950	1960	Changes Number	1950-1960 Percent	1960	1970	Changes Number	1960-1970 Percent
Total	7,232	7,295	+ 63	+ 0.9	7,295	7,300	+ 5	+ 0.1
Urban (Inc. Towns)	2,742	3,222	+480	+17.5	3,222	3,500	+278	+ 8.6
Rural	4,490	4,073	- 417	- 9.3	4,073	3,800	- 273	- 6.7
Farm	3,889	3,310	- 579	- 14.9	3,310	2,850	- 460	- 13.9
Non Farm	601	763	+162	+27.0	763	950	+187	+24.5

Sources: 1. U. S. Census of Population
2. Intermountain Planners, Inc.

TABLE 2

Age & Sex Composition of Teton County

	1950		1960	
Age Group	Male	Female	Male	Female
Under 5	444	420	452	406
5-14	701	689	878	805
15-19	285	223	283	244
20-24	247	209	161	183
25-34	581	545	404	403
35-44	508	435	509	482
45-54	373	327	429	364
55-64	415	315	314	251
65-74	221	160	255	231
75 +	77	57	136	105
Total	3,852	3,380	3,821	3,474

Source: U. S. Census of Population

TABLE 3

Population Forecast for Towns and Communities Teton County

	1950	1960	1970	1975	1980	1990
Choteau	1,618	1,966	2,150	2,225	2,310	2,550
Fringe	NA*	NA*	60	67	73	80
Dutton	431	504	525	530	534	550
Fringe	NA*	NA*	17	20	25	30
Fairfield	693	752	825	845	880	960
Fringe	NA*	NA*	80	87	95	110
Bynum	85	40	45	42	40	37
Collins	32	25	20	18	5	10
Farmington	NA*	NA*	15	14	14	13
Pendroy	60	30	45	42	38	30
Power	160	175	125	130	137	150

Sources: 1. U. S. Census of Population
2. Intermountain Planners, Inc.

* Not Available

Housing

Teton County 1960

CHART 6
Housing Classification

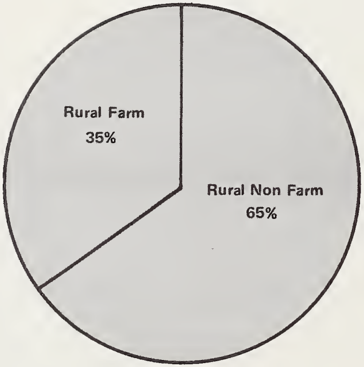


CHART 7
Housing Tenure

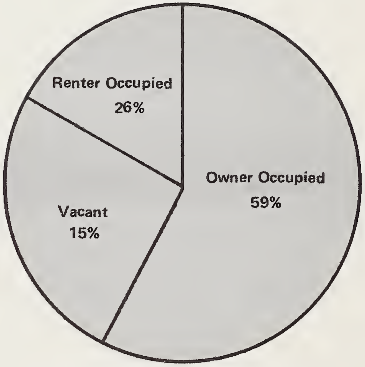
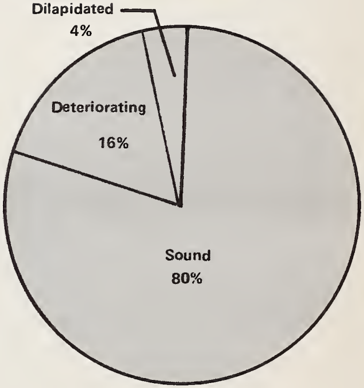


CHART 8
Housing Condition

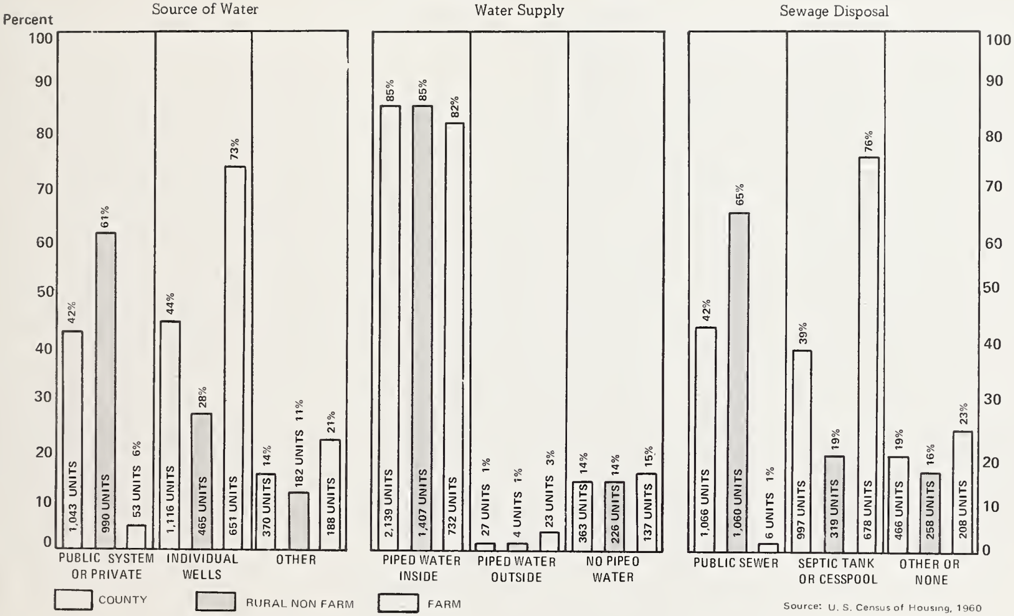


Source: U. S. Census of Housing, 1960

CHART 9

Water and Sewer

Teton County 1960



Source: U. S. Census of Housing, 1960

THE ECONOMY

LABOR

People are important to the economy of Teton County for two reasons. First, they are producers of goods and services, and, secondly, they are consumers of goods and services also. The following analysis is concerned primarily with the total economic spectrum and how it may affect the future of Teton County. Changing economic conditions can have either a good or a bad effect on an area in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

The overall employment picture remained fairly stable in the county between 1950 and 1960. The only differences were the internal changes that occurred within the major industry groups. While the rate of employment growth remained stable in the county, Montana recorded a six percent gain over the same period.

The past employment change by major industry group is shown in Chart 10. Significant increases were noted in the trade and in the service and finance industry groups suggesting their ancillary role in support of the agricultural segment of the economy.

Chart 10 indicates the preponderance of the agricultural industry group over that of other groups. Agriculture is the mainstay of the economy in the county and will continue in that role in the forseeable future.

The percentages for employment by industry group, as noted in Table 4, provide an insight into the employment characteristics for Teton County. This table shows the relative weight of each industry group and offers a comparison with that existing in 1960 for the State of Montana and for the United States.

As previously mentioned, the agricultural element in the county overshadows the other segments of the labor force. The county had forty four percent of its total labor in the agricultural group or more than twice that for the state and four times that for the nation.

The economy of the county appears to be stable in view of the percent of the total labor force engaged in the various industry groups. The relative weights of the transportation and utilities, the trade, and the service and finance groups to the total employment picture indicate an existing self reliant economic framework.

The available labor statistics for 1969 indicate some far reaching changes occurring within the employment scene in Teton County. First, a substantial growth is noted in the mining industry; 1969 recorded a total of 153 employees in that industry as compared to only twenty one in 1960. Secondly, the construction employment has dropped from 157 in 1960 to twenty seven in 1969.

The economy of the county is, and will continue to be, agricultural and the sale of crops and livestock is the mainstay for dollar sales. The agricultural picture is covered in detail below.

AGRICULTURE

A farm is defined by the United States Census as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 745 farms in Teton County in the above category in 1964, or eleven percent fewer than there were in 1959.

The 1964 classification of farms by type in Teton County was as follows:

Field crop farms other than vegetables, nuts, and fruit		432
Cash grain	431	
Other field crop	1	
Poultry farms		3
Dairy farms		28
Livestock farms other than poultry and dairy		158
General farms		59
Miscellaneous and unclassified		65
Total		745

Of the total number of farms, thirty were classified as part time and twenty eight were classified as being operated by semi retired persons.

Farms in Teton County are generally large in size and almost three out of every four produce grain crops. In 1964 the average farm size was 1,639 acres. Chart 12 indicates that just less than half of all farms exceeded one thousand in size. At the same time only twenty percent were under 259 acres.

The value of products sold by the number of farms further indicates the size of the agricultural operations in the county. As indicated in Chart 13, two thirds of all farms recorded sales in excess of $10,000 in 1964 while almost one farm in three noted sales over $20,000.

In 1964 the sale of crops accounted for almost two thirds of the total value of all products sold in the county. Throughout the four year period the preponderance of crop sales over livestock sales remained about the same and indicates the importance of crops in the agricultural economy.

The following cash receipts data for Teton County from 1964 to 1967 gives an indication of the importance of the sale of crop products to the agricultural industry.

Year	Livestock	Crops	Total
1964	$4,416,600	$6,636,100	$11,052,700
1965	$5,193,200	$7,539,100	$12,732,300
1966	$5,673,000	$9,018,000	$14,691,000
1967	$6,082,200	$9,087,600	$15,169,800

The western part of the county is primarily a grazing area, suitable chiefly for the production of livestock. The central, southern and eastern parts of the county are tillable, and much of the land there is irrigated.

The outlook for agriculture in the county is to continue as it has in the past. There will be a gradual reduction in the number of farms as the small farms are replaced by larger scale operations and by the continued growth of the rural non farm population.

TABLE 4

Percent of Total Employment by Industry Groups Teton County, Montana and United States

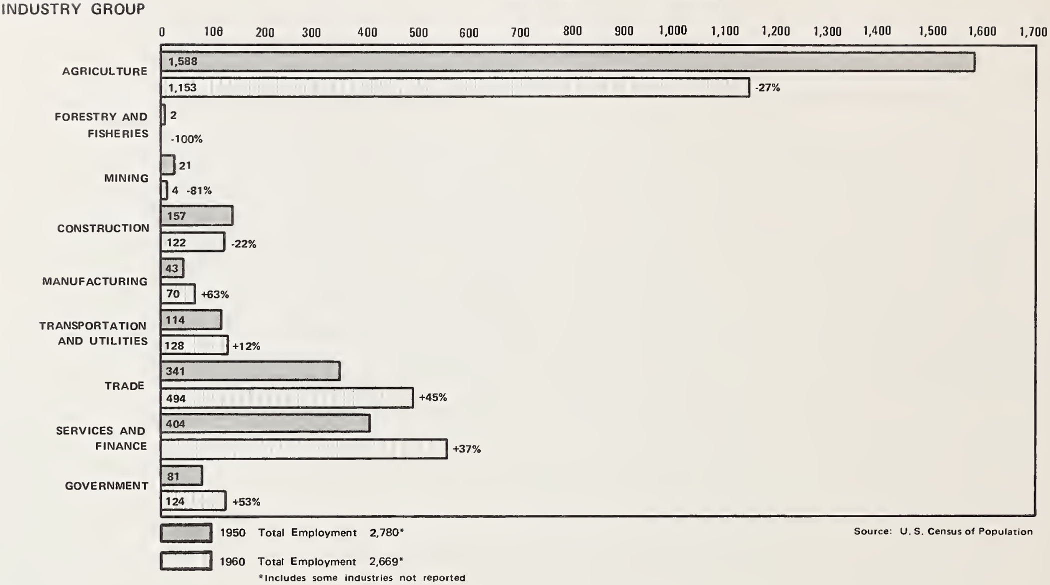
	Teton County	Montana	United States
Agriculture	44	17	11
Forestry and Fisheries	0	1	1
Mining	1	3	1
Construction	5	7	5
Manufacturing	3	10	27
Transportation and Utilities	5	9	7
Trade	18	21	19
Services and Finance	20	26	16
Government	4	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

CHART 10

Employment Change by Major Industry Group

LABOR Teton County 1950-1960 FORCE

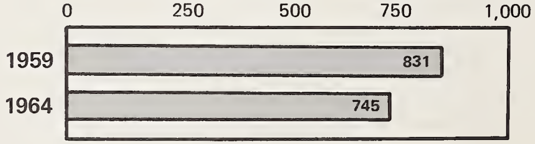


Source: U. S. Census of Population

CHART 11

Number of Farms

Teton County 1959-1964



Source: U. S. Census of Agriculture, 1964

CHART 12

Farms by Size

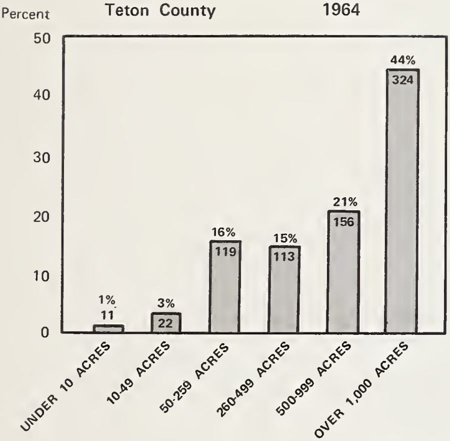
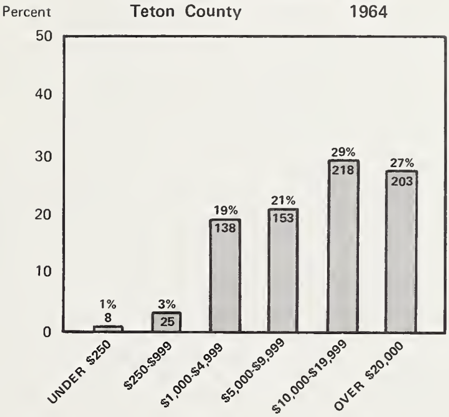


CHART 13

Number of Farms by Value of Farm Products Sold



Source: U. S. Census of Agriculture, 1964

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Teton County and to analyze their economic structure. At present, there are four separate local governmental units in the county involved within the scope of the water and sewer study. Included are the incorporated cities of Choteau, Fairfield, and Dutton, and the government of Teton County.

A Board of County Commissioners, presided over by a chairman, governs Teton County. The three incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipality has power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities*

Teton County 1969

	Revenue	Expenditures	Assessed Valuation
Teton County	$1,045,416.00	$1,045,416.00	$48,030,011.00
Choteau	133,164.00	150,875.56	5,216,322.00
Fairfield	204,786.91	201,447.79	2,481,979.00
Dutton	72,700.61	66,720.71	1,388,869.00

* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

GENERAL

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major river drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and thus degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can help to avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of the planning report, the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface water and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by United States Public Health Service.

SURFACE-WATER RESOURCES

Teton County has an extensive drainage system which has characteristics of both mountainous and plains topography. Drainage within the county may be found running in almost any direction; however, the main drainage pattern is to the east. Elevation differences across the county exceed five thousand feet and add to the complex surface drainage system. The highest elevations, nearly nine thousand feet above sea level, occur along the Continental Divide in western Teton County. Elevations decrease in an easterly direction across the county, and reach levels at just over three thousand feet along the Teton River near the Teton-Chouteau County line.

The Teton River is the major drainage feature of the county. The Teton, which heads in west-central Teton County, flows approximately the entire east-west length of the county before entering Chouteau County east of Collins. The Teton River flows east through Chouteau County to a point north of Fort Benton where it joins the Missouri River.

Other important streams in the county drainage system are Deep Creek, Muddy Creek, North Fork of the Sun River, and Upper Dupuyer Creek. Deep Creek heads in southwest Teton County, flows northeasterly approximately forty miles, and joins the Teton River near Chouteau. Muddy Creek heads in northwest Teton County, flows southeasterly approximately fifty miles and joins the Teton River near Collins. Upper Dupuyer Creek heads in the northwest county area and flows approximately ten miles in a northeasterly direction before entering Pondera County. The North Fork of the Sun River drains the entire western fringe of the county. The river forms the border between Teton County and Lewis and Clark County for more than thirty miles above Gibson Reservoir. Below Gibson Reservoir, the Sun River forms the border between Teton, Lewis and Clark, and Cascade Counties.

The above streams in Teton County provide a yearlong source of water for irrigation, livestock, and domestic needs. Many of these streams have gaging stations installed by the United States Geological Survey where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for each gaging station pertinent to the county.

Two reservoirs in Teton County add significantly to the irrigation facilities. The largest is Gibson Reservoir located on the North Fork of the Sun River in southwestern Teton County. The reservoir is used primarily for irrigation purposes and has a usable capacity of 105,000 acre-feet. Pishkun Reservoir, located northwest of Augusta, is also used to store water for irrigation purposes. The reservoir, which has a usable capacity of 32,050 acre-feet, receives water by canal from the North Fork of the Sun River.

The climate of Teton County varies considerably from one area to another because of the wide range of topographic conditions. The effect that the topography has on the climate is very important to the water resources of the county. Prevailing west to southwest winds flowing across the high mountains in western Teton County provide the highest annual precipitation values. Nearly sixty inches of annual precipitation are estimated to fall in some of the mountainous areas. Average annual precipitation values at the lower elevations in eastern Teton County range between eleven and fourteen inches.

In general, precipitation occurs as steady rains in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. Snow does not tend to remain on the ground in the lower elevations of the county due to "chinook" wind conditions and frequent winter warming spells. Snow begins to accumulate in November in the higher mountain valleys, however, and continues to build up until late March or early April. Portions of the high mountain snowpack in Teton County and in other adjacent drainage areas remain until the warm temperatures of late July and August begin to melt them. The runoff from the snowpack at this time of the year coincides with the period of maximum demand for water in the valleys below.

The use of surface water in the county is widespread for domestic, industrial, agricultural, and recreational purposes. Agricultural uses of water predominate over all others in the county. Over 140,000 acres are presently under irrigation in Teton County and a potential exists for more development. A final but important use of surface water in the county is for recreational purposes. The mountain lakes and streams in the county are ideal habitat for fish and waterfowl and draw many fishermen, hunters, and campers to the area each year.

As is the case in most counties in Montana, water appropriated for use in Teton County far exceeds the

TABLE 6
Stream Gaging Stations

	Gaging Sta.	Drainage	See	Discharge (cfs)					Yearly	Runoff - (1,000 Acre-Ft)			
Stream	Location	Area (sq Mi)	Notes	Max.	Date	Min.	Date	Average	Average	Max.	Date	Min.	Date
1. North Fork Sun River	25 mi. northwest of Augusta	258		4,840	6/ 3/48	27	11/21/49	364	16	332.4	1959	200.4	1949
2. Sun River	18 mi. northwest of Augusta	*		32,300	6/21/16	3.4	4/18/38	820	37	1,173	1916	272	1931
3. Muddy Cr.	1 3/4 mi. west of Power	137		870	6/24/38	0.2	5/27/36	*	*	21.67	1938	15.99	1936
4. Teton River	20 mi. west of Farmington	105		2,780	6/ 3/48	12	3/28/51	165	7	163.1	1953	67.26	1949
5. Teton River	14 mi. northwest of Choteau	170	2	3,810	6/21/16	No Flow	At times 1920-21	151	9	163.0	1916	25.6	1919
6. Spring Cr.	13 mi. west of Choteau	5.17		66	5/31/17	0.4	8/31/19	*	*	*	*	*	*
7. Spring Cr.	10 mi. northwest of Choteau	10.4	2	138	5/26/17	5.0	9/26/19	*	*	*	*	*	*
8. Teton River	1 1/2 mi. south of Choteau	260	1,2	4,500	6/22/16	1.0	8/16/13	*	*	*	*	*	*
9. Deep Cr.	5 mi. southwest of Choteau	240	2	3,700	6/21/16	3.0	7/27/19	70.4	13	119	1916	20.4	1919
10. Willow Cr.	9 mi. southwest of Choteau	120		880	6/21/16	No Flow	9/30/14	29.4	5	39.2	1917	8.45	1915
11. Teton River	10 mi. northeast of Dutton	1,308	2	1,310	6/21/58	20	1/26/57	157	6	147.4	1958	92.65	1960

Source: "Water Resources Survey" Teton County, Montana
Montana Water Resources Board, Helena, Montana, 1962

* Not recorded

Note: 1. Only fragmentary records are available for these stations
2. Irrigation diversions occur above these stations

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amount available. Only a few streams in the county have decreed rights. An example of the inequity is the comparison of the average flow of the Teton River with the appropriation for the stream and its tributaries. The appropriation on record as of 1962 was 50,893.48 cubic feet per second. As shown in Table 6, the average flow of the river northeast of Dutton for a six year period was 157 cubic feet per second. The maximum discharge recorded on the Teton River occurred during the spring runoff in 1916 and reached a value of only 3,810 cubic feet per second.

WATER USE CLASSIFICATIONS

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages in Teton County and adjacent areas have been classified as follows:

Missouri River (mainstem) from Sun River to Rainbow Dam	$B-D_2$
Missouri River Drainage from Rainbow Dam in Great Falls to the North Dakota line except the portion of the mainstem and the tributaries listed below:	$B-D_3$
Sun River Drainage to, but excluding, Muddy Creek near Vaughn	$B-D_1$
Muddy Creek Drainage	E
Sun River (mainstem) from Muddy Creek to the Missouri River	$B-D_3$
Tributaries (if any) to the Sun River from Muddy Creek to the Missouri River	$B-D_1$
Teton River Drainage to and including Deep Creek near Choteau	$B-D_1$

Remainder of Teton River Drainage	B—D_2
Marias River Drainage except selected tributaries in Glacier and Pondera Counties	B—D_2

GROUND-WATER RESOURCES

Ground water is widely used in Teton County for stock, domestic, and irrigation purposes. As of January 1970, 1,037 well and 277 spring appropriations were on file with the Montana Bureau of Mines and Geology. There is approximately one well for every two square miles in the county, with sixty eight percent of the wells reportedly used for domestic purposes, twenty two percent for stock, and five percent for irrigation. Fifty nine percent of the springs are used for stock, fifteen percent for irrigation, and seven percent for domestic purposes. The communities of Dutton, Fairfield, and Choteau report using ground water for municipal purposes. With the exception of a reconnaissance study by Fisher in 1909 (U. S. Geological Survey Water-Supply Paper 221) that included the southeastern part of Teton County, there have been no technical ground-water investigations in this area.

The geological history of Teton County includes long periods of sedimentation and erosion and periods of upheaval and structural deformation. During the Pleistocene epoch (less than one million years ago) much of the eastern part of the county was covered by huge continental ice sheets that upon retreat of the ice left widespread glacial deposits. Contemporaneous with the continental glaciation, alpine glaciation has altered the mountains of western Teton County and left glacial deposits in many of the mountain valleys.

The mountains in western Teton County are composed of sedimentary rocks that range in age from Cambrian (500 to 600 million years old) to Cretaceous (65 to 135 million years old). These rocks were uplifted, faulted, and folded during the Tertiary period (less than 65 million years ago) and have subsequently been dissected by streams. A wide variety of rock types is present in the mountains, including limestone, dolomite, sandstone, and shale. Few wells are present in this part of the county, but it is reasonably certain that some of these formations contain ground water.

The dominant geological feature of the county is the Sweetgrass Arch. The southern part of this broad arch, known as the South Arch, trends northwest southeast through the central and eastern parts of Teton County. The Sweetgrass Arch was formed by uplift of sedimentary rocks over a wide area. After uplift erosion slowly reduced the area to a plain. The Two Medicine Formation and underlying Virgelle Sandstone of Cretaceous age were completely removed over much of the arch. Similarly, much of the Colorado Group, which underlies the Virgelle, was removed. In the central part of the county along the western flank of the South Arch, the Virgelle Sandstone and Two Medicine Formation immediately underlie the glacial deposits and are used as a source of ground water. There has been very little study of the Two Medicine and Virgelle Sandstone in Teton County. North of Teton County, the Two Medicine is a sequence of clay, shale, and sandstone, with sandstone becoming abundant in the lower 150 feet. The Two Medicine has a total thickness of about two thousand feet, but erosion has removed much of the formation. Sandstone zones in the Two Medicine will probably yield small to moderate quantities of water to wells in Teton County.

The Virgelle Sandstone, north of Teton County, consists of about two hundred to three hundred feet of massive sandstone that will yield moderate quantities of water to wells. The Virgelle probably has similar geological and hydrological characteristics in Teton County.

Between the mountains in western Teton County and exposures of the Two Medicine and Virgelle Sandstone on the west flank of the South Arch is an area composed of faulted and folded rocks of Cretaceous age. Most of the formations are part of the Montana Group, which consists of the Horsethief Sandstone, Bearpaw Shale, and Two Medicine Formation. The water-bearing characteristics of these formations are poorly known. The Horsethief Sandstone and the lower part of the underlying Two Medicine Formation are sandstones that should yield small to moderate quantities of water to wells.

On the crest and eastern flanks of the South Arch (central and eastern Teton County), shales of the Colorado Group are present directly beneath the glacial till. Generally, formations of the Colorado Group are poor aquifers; however, near the base of the Colorado are some sandstone beds that may yield water. The quality of this water is probably poor, and few wells have been drilled into the Colorado.

Beneath the Colorado Group are a number of deeply buried sedimentary formations that contain ground water; however, the water is generally of poor quality and, except for specialized uses, has limited value.

Glacial deposits of Pleistocene age are widespread in Teton County. The northeastern part of the county is covered by terminal and ground moraine deposits of a compacted mixture of boulders, sand, gravel, silt, and clay and range in thickness from a few feet to over seventy five feet. Water yields from morainal deposits vary widely, but generally wells in these materials will yield small quantities of water. Outwash channel deposits are also present in scattered locations in the terminal and ground moraines. Outwash channel deposits usually consist of sand and gravel and will usually supply moderate to large quantities of water to wells.

During the period of continental glaciation northward-draining streams were blocked by ice and large lakes formed. Glacial lake deposits consisting of fine-grained sand, silt, and clay are present in a strip about five to eight miles wide extending from Agawan to Power. These lake sediments were deposited from ancient Lake Choteau. These deposits probably do not exceed fifty feet in thickness and, except for some sandy zones, are generally poor aquifers.

Glacial deposits derived from alpine glaciers that advanced eastward from the mountains are present near the mountain front in the vicinity of the Pishkun Bird Reservation and along the Teton River. These glacial deposits have not been studied but should contain sand and gravel zones that would yield water to wells.

In addition to bedrock and glacial deposits, there are terrace deposits of Tertiary age (between one and 65 million years old) in many parts of Teton County. The terrace deposits are not widely used as a ground-water supply but should yield moderate to possibly large quantities of fair-quality water.

TABLE 7

Chemical Analysis of Municipal Water Supplies

(All Figures in Milligrams per Liter)*

City or Town	**Choteau**	**Choteau**	**Choteau**	**Dutton**	**Fairfield**	**Fairfield**	**Fairfield**	**Fairfield**
Source	Composite Well	Upper Spring No. 1	Lower Spring No. 2	Well	Well No. 1	Well No. 2	Well No. 3	Well No. 4
Date	9/69	9/69	9/69	9/66	8/67	8/67	8/67	12/68
Total Solids	342	298	318	990	326	348	270	216
Hardness	300	290	300	490	300	270	205	140
Ca	76	76	80	112	30	20	26	20
Mg	27	24	14	51	55	54	34	22
Na+K	0	0	21	130	19	41	40	61
CO_3	0	0	0	0	0	0	0	0
HCO_3	286	280	286	280	348	375	302	268
SO_4	57	49	51	490	29	31	31	29
Cl	6	7	9	20	7	7	3	10
NO_3	0.6	0.6	0.0	0.0	17.7	15.6	9.3	9.2
F	0.42	0.40	0.40	0.5	0.8	0.9	0.8	1.04
Fe	0.0	0.0	0.0	1.60	0.00	0.00	0.00	0.00
As	0.001	0.001	0.000	0.00	0.00	0.00	0.00	0.00
Pb	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zn	0.00	0.00	0.00	–	0.00	0.00	0.00	0.01

* See Appendix I, Table A, for accepted water quality standards

Source: State Department of Health, Helena, Montana

Small amounts of Recent (less than twenty thousand years old) alluvium are present along major streams in the county. The alluvium is generally thin and is composed of fine-grained materials with some layers and lenses of sand and gravel. The alluvium should yield small to moderate amounts of water where there is a sufficient thickness of saturated sand and gravel.

Recharge to ground water is from precipitation, infiltration of streamflow, and infiltration of irrigation water in areas where irrigation is widespread. Quality of ground water in Teton County is poorly known. Generally, water quality should be fair to good where bedrock aquifers are recharged by precipitation, but, as the distance to the recharge area increases, water quality probably becomes poorer. Gravel terrace deposits and glacial outwash channels usually contain fair to good quality of water. (See Table 7 for chemical analysis of municipal water supplies in Teton County. See Table A in Appendix I for accepted water quality standards.)

The ground-water resources of Teton County generally have not been studied. Ground water is generally available in small to moderate quantities, but water is a problem in some aquifers. Detailed hydrogeological studies will be needed in this area to accurately delineate the areal extent, potential yield, and quality of water in each geological formation. There will surely be continued development of ground water in Teton County for stock and domestic purposes, and there will probably be some additional municipal and irrigation water development.

Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
2. State Department of Health, Helena, Montana
3. "Water Resources Survey" Teton County, Montana, Montana Water Resources Board, Helena, Montana, 1962

THE SOILS

GENERAL

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Teton County has an interesting and quite complicated geologic history which has greatly influenced the soil structure of the area. The dominating geologic features of the county are the mountainous areas along the western county line. As a result of the advance and recession of glaciers in the area, much of the county is covered by glacial outwash. Also, extensive drainage from the mountains has resulted in the filling of many stream valleys with alluvial gravels. The soils of Teton County are made up of the alterations of the parent materials due to various conditions of climate, topography, and living organisms.

It has been determined that the soils of Teton County fall in the category of approximately seven Great Soil Groups as outlined in the pedological system of soil classification. These groups include Alluvial, Lithosol, Brown, Chestnut, Chernozem, Solodized-Solonetz, and Gray Wooded soils.

Alluvial soils are young soils found along streams and valley floors. The material has undergone little or no modification except for a slight accumulation of organic matter in the surface.

The lithosols are thin surface soils usually closely underlain by soft or hard rock. They are young soils with relatively little development and are commonly found on mountain slopes and hilly areas.

Brown, Chestnut, and Chernozem soils are generally formed under varying conditions of precipitation and are commonly found in upland regions. Brown soils are formed in areas where the annual precipitation is less than fourteen inches per year. Brown soils are characterized by a thin, light-gray surface layer underlain by eight or nine inches of clay and on into a gray calcareous layer of one to three feet.

Gray wooded soils occur primarily in mountainous regions. Mean annual precipitation values range from twelve to twenty five inches in areas where these soils are found.

SOIL MAP

The Soil Conservation Service of the United States Department of Agriculture has prepared a general soils map for Teton County. The soils map as presented by them is shown as Map 4 in this report. In developing this map, the Soil Conservation Service made field studies and observations which resulted in the discovery of thirteen general soil areas. Each general soil area, as a rule, contains a few major soils and several minor soils. Soils within an area may differ greatly in short distances and any one soil may occur in more than one area. Thus, the general soils map does not show the kind of soil at any particular point but shows specific patterns of soils.

The Soil Conservation Service preliminary draft descriptions of the seven soil areas shown on the general soils map are presented below. The numbers preceding each description correspond to numbers on Map 4.

1. Areas dominated by moderately deep and very shallow stony soils and rock outcrops of igneous and limestone materials of the very steep mountains.
2. Areas dominated by deep and moderately deep, well drained, dark colored stony loam soils on steep and hilly lands in the foothills.
3. Areas dominated by moderately deep and shallow, well drained, moderately dark colored loam and clay loam soils on rolling to steep shale and sandstone uplands. Soils on nearly level to sloping high outwash fans and terraces are included.
4. Areas dominated by deep, well drained and moderately well drained, moderately dark colored loam and gravelly loam on nearly level terraces and high outwash benches.
5. Areas dominated by deep, well drained, dark colored loam and very gravelly loam on gently sloping to hilly outwash benches and fans.
6. Areas dominated by deep, well drained, moderately dark and light colored, calcareous clay soils on nearly level to undulating glacial meltwater deposits. Also included are soils with dense, very slowly permeable subsoils on low terraces and along drainageways.
7. Areas are dominated by deep, well drained, moderately dark and light colored loam and clay soils on nearly level to rolling glacial till and glacial meltwater deposits.
8. Areas dominated by deep, well drained, light colored gravelly loam on nearly level high outwash benches and shallow clay loam soils on steep shale uplands.
9. Areas dominated by deep and moderately deep, well drained, light colored clay loam soils on undulating to steep shale and sandstone uplands.
10. Areas dominated by saline and alkali soils on nearly level to gently sloping terraces.
11. Areas dominated by deep, well drained to poorly drained clay loam and saline soils on nearly level to gently sloping terraces and stream bottoms. Included are shallow clay loam soils on the steep shale uplands.
12. Areas dominated by deep and moderately deep, well drained loam to clay soils on gently sloping to rolling shale uplands and fan terraces. Included are areas of seeped and saline soils.
13. Areas dominated by deep and moderately deep, well drained and somewhat poorly drained, dark colored loam or clay loam and gravelly clay loam soil on nearly level to sloping terraces, bottomlands, and flood plains.

CONCLUSIONS

The soils of Teton County have generally been easy to deal with where shallow domestic water wells and individual sewage drain fields have been constructed. The large amounts of alluvial gravels and glacial till have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drain fields. In areas of extensive clay and silt deposits, even more care must be taken in the construction of septic tank drain fields.

Construction of water and sewer systems in the various soils of Teton County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse stream gravels slow operations somewhat. Some bedrock might be encountered at normal water and sewer line installation depths.

Sources: 1. U. S. Department of Agriculture, Soil Conservation Service, Great Falls, Montana

2. "Water Resources Survey" Teton County, Montana, Montana Water Resources Board, 1962

COMMUNITY WATER SYSTEM FACILITIES

GENERAL

This comprehensive report covers the overall problems, existing or projected, for Teton County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the overall needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for sufficient water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities, a system with capacity enough to give high ratings for fire protection would require a system considerably larger than necessary for domestic purposes and one that the community might be unable to finance. The approach in such cases has been to propose a system suitable for present domestic needs. These basic facilities can then be expanded for more complete service and for higher ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water usage for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

BASIC CONSIDERATIONS

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits the type of water facilities available was examined and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities, the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths. For such situations, private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities, population is increasing and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the residents now with provisions for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water

systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

TETON COUNTY

The estimated 1970 population of Teton County is 7,300. Approximately 3,657, or fifty percent, of these people are presently served by a central water system and the remainder are served by such private facilities as wells and springs. If the schedule of proposed improvements outlined in this report is followed about 4,094, or fifty eight percent, of the estimated population will have access to central water systems by 1990. It is expected that the remaining forty two percent will live in the outlying areas and the homes will not be close enough together to make central systems feasible.

CHOTEAU

Existing System. The estimated 1970 population for the city and the fringe areas is 2,210. The community is expected to show a steady population increase throughout the planning period. The area presently served by the community water system is shown on Map 5.

The supply of water for their system is obtained from a series of wells and springs. The combined capacity of these facilities is about one thousand gallons per minute (gpm). Some variation in the amount of water available exists during different time of the year. A ten inch supply line carries water from the source of supply to the storage facilities located to the east of the city. The capacity of this storage is 750,000 gallons. A series of smaller sized pipe distributes the water throughout the city. The existing storage facility and the distribution system adequately serve the needs of the present population. The supply of water available is reportedly not adequate for their needs.

Improvements Next Five to Ten Years. The population is expected to be 2,292 by 1975. A study by a private engineering firm has been conducted to determine an additional source of water supply. The city is planning to construct an infiltration gallery near the site of the present springs. Indications are that a source of supply yielding a constant amount of water at all times of the year can be developed. An adequate supply of water to alleviate their present shortage can be obtained in this manner. It is proposed that this facility be capable of producing 450 gpm. This improvement will result in a system which will adequately serve the domestic needs of the anticipated future population.

Improvements by 1990. By 1990 the population will have reached 2,630. The present system together with the proposed enlargement of the water supply under the five to ten year plan will result in a system which is adequate for the domestic demands of this population. The only additional improvements which are believed to be necessary would be the expansion of the present distribution system to serve additional area.

FAIRFIELD

Existing System. The estimated 1970 population is 905. The population is expected to increase steadily throughout the planning period. A community water system is presently in existence and the layout is shown on Map 6. The supply of water is obtained from a series of three wells. The combined capacity of these wells is 485 gpm. Normally, this would be an adequate water supply for a community of this size; however, the yield from these wells is not constant at all times of the year. The wells are about thirty feet in depth and the amount of water obtainable is affected by the amount of irrigation that is conducted in the area. During the irrigation season large amounts of water percolate through the ground thereby recharging these wells. When irrigation ceases in the fall the water table subsides and the depth of water in these wells is reduced sufficiently to cause a shortage of water for the municipal water system. There is reportedly an existing well located just south of the community. They are planning to connect this well to the system to supplement their water supply. The capacity of this well is not known; however, it is expected that about one hundred gpm would be obtained. The distribution system is considered to be in good condition and adequately serves the needs. Storage facilities presently consist of a sixty thousand gallon elevated storage tank.

Improvements Next Five to Ten Years. The estimated 1975 population is 932. It is proposed that the fourth well be tied into the present system by this time. It is expected that the combined capacity of these four wells would be sufficient for their needs during this period. The existing storage facilities is considered to be too small for the needs of this population. An additional 100,000 gallon elevated tank is proposed as shown on Map 6. The additional storage will provide considerable reserve for domestic use during periods when the well yield is reduced. It is believed these improvements will result in a very adequate amount of water being available to the residents.

Improvements by 1990. The estimated 1990 population is 1,070. It is expected that the present system together with the improvements proposed during the five to ten year period will result in a system which is adequate for their needs throughout the planning period. If the present water shortage continues to exist, it is proposed that a more detailed study be conducted whereby an alternate water supply could be determined. It is proposed that studies of the fluctuation in water table be conducted to determine the possibility of locating an infiltration gallery at such a depth that a uniform amount of water could be obtained at all times of the year.

DUTTON

Existing System. Presently 542 persons reside in this community. The existing community water system adequately serves the needs of this population. The water supply is obtained from a well located six miles north of the community near the Teton River. An eight inch supply line carries water from the well to the distribution system. This supply line has a very adequate capacity. The distribution system adequately serves the needs. It consists of wooden pipe; however, the pipe is reportedly in good condition. Storage is provided by means of a 100,000 gallon elevated storage tank.

Improvements Next Five to Ten Years. The estimated population for 1975 is 550. The present system is considered to be adequate for their needs during this period. It is not believed that expansion or improvement is necessary to serve this population.

Improvements by 1990. The population is expected to be 580 by 1990. The present system is considered to be adequate for their needs throughout the planning period.

POWER

Existing System. The estimated 1970 population is 125. The residents find it necessary to haul their drinking water since the well water obtainable in the area is of a rather poor quality. They are presently planning a water system for the community. This facility is necessary and the number of persons which would benefit make the project feasible.

Improvements Next Five to Ten Years. The estimated 1975 population is 130. A private engineering company has prepared a proposed system for the community. It consists of a reservoir on Muddy Creek about one and one half miles west of the community. A treatment plant will be necessary for the water obtainable from this source. Pumping facilities capable of producing one hundred gpm are proposed. This pumping facility will provide constant pressure to the distribution system since elevated storage facilities are not proposed. A four inch supply line will transmit the water from the reservoir to the distribution system. This facility is considered to be adequate for their needs throughout the planning period.

Improvements by 1990. The estimated 1990 population is 150. The system as proposed under the five to ten year plan will have sufficient capacity to serve this additional population. It is not believed that any expansion or improvements to this system will be necessary.

PENDROY

Existing System. There are presently forty five persons residing in this community. Population projections indicate that the population will be decreased by about one third by 1990. The residents presently obtain their water supply from private wells and some hauling of water from suitable sources is also necessary. A good quality water is obtained by all residents from one of these sources. In some areas of the community, rather small quantities of water are obtained; however, the amount is adequate for their needs. Wells range in depth from about twenty to one hundred feet. Some of the water obtainable from the shallow wells is questionable as to its purity; however, tests are periodically conducted as a safeguard.

Improvements Next Five to Ten Years. The estimated 1975 population is forty two. It is proposed that a community water system be developed. A suitable water supply could be obtained by developing the shallow water source available in this community. It is considered feasible to construct one good well with proper chlorination facilities to insure the purity of the water obtainable at shallow depths. A constant pressure pumping facility capable of producing fifty gpm would be adequate for their needs.

Improvements by 1990. The estimated 1990 population is thirty. It is believed that this figure would be considerably larger if an adequate water system were in existence. The system as proposed under the five to ten year plan would be adequate for their needs throughout the planning period.

BYNUM

Existing System. The estimated 1970 population is forty five. The residents presently obtain their water supply from private wells. The quality of water obtainable is quite varied; however, most wells produce a good quality water. Some of the deeper wells do produce water with a high chemical content. Most wells are shallow with depths from about eight to twenty five feet. These shallow wells do present a potential pollution problem. It is feasible to construct a community system and it is recommended that this be done.

Improvements Next Five to Ten Years. The population is expected to be forty two by 1975. It is proposed that a shallow well be constructed to provide a safe water supply for the residents of this community. This facility would use the rather good quality surface water available in the area but the purity of the water would have to be controlled by chlorination facilities. A constant pressure pumping facility capable of producing fifty gpm would be adequate for their needs.

Improvements by 1990. Population is expected to decrease to thirty seven by 1990. It is believed that this decrease in population could be reduced if adequate sanitary facilities were available. The proposed water system is also feasible for this reduced population.

FARMINGTON

Existing System. The estimated 1970 population is fifteen. The population is expected to remain steady throughout the planning period. The residents presently obtain their water supply from private wells. The quality of water is considered to be very good and the quantity very adequate for their needs. The homes are spread over a rather large area so that contamination from septic tank overflows is not considered to be a problem with these shallow wells. The systems which are presently in operation are considered to be adequate for the needs of the community throughout the planning period.

COLLINS

Existing System. The estimated 1970 population is twenty. It is expected that this population will reduce to ten by 1990. The residents presently obtain their water supply from private wells or the water is hauled from a more suitable source. All residents obtain an adequate water supply from these sources. A community water system facility is not believed to be feasible for this community. The present means of obtaining water will be adequate for the needs throughout the planning period.

COMMUNITY SEWER SYSTEM FACILITIES

GENERAL

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes is an important and necessary use of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes, if discharged into water courses, can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution, by definition and interpretation, is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy, established by the state legislature, to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act, in reference to pollution abatement, gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, or animal and agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration in this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in the "Analysis Criteria" in Appendix III will suffice in practically all cases.

BASIC CONSIDERATIONS

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions,availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial waste shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants, or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

TETON COUNTY

Approximately 3,657 people, or fifty percent of the Teton County population, are presently served by community sewage facilities. The proposed expansion program outlined in this report would result in about 4,430, or sixty six percent, of the 1990 population having access to community facilities. The remaining thirty four percent will live in outlying areas and the homes will not be close enough together to make community systems feasible.

CHOTEAU

Existing System. The present population of the city and the fringe area is 2,210. This population is presently served by a community sewer system which adequately handles the needs. The collection system has adequate capacity for present and future population. An eighteen inch outfall line presently carries sewage to the treatment facilities entirely by gravity. This outfall line has adequate capacity for the projected population expected during the planning period. Sewage treatment is provided by means of a twenty acre wastewater stabilization pond located to the south of the city.

Improvements Next Five to Ten Years. The estimated 1975 population is 2,292. It is proposed that an addition to the present wastewater stabilization pond be made by 1990. This addition should have a surface area of six acres. The need for this addition is not immediately apparent; however, population predictions indicate that overloading of the present facility will occur during the planning period.

Improvements by 1990. The estimated 1990 population is 2,630. The expansion of the sewage treatment facilities as proposed under the five to ten year plan will result in a total surface area of twenty six acres. This treatment facility will then have adequate capacity for the predicted 1990 population. The only additional improvements which are believed to be necessary during the planning period would be expansion of the existing collection system to provide service to new areas of development.

FAIRFIELD

Existing System. The 905 residents who presently reside in this community are served by a community sewer system facility. The collection system is reportedly in good condition and has an adequate capacity to serve the present population and the additional increase which is expected to occur in this community. A twelve inch outfall line carries sewage to the sewage treatment facilities entirely by gravity. Sewage treatment consists of a ten acre wastewater stabilization pond. This facility has adequate capacity for present sewage flows as well as those which are anticipated during the planning period.

Improvements Next Twenty Years. The population is expected to be 1,070 by 1990. The present sewage facility will adequately serve the needs of this population. No expansion or improvement of the system is considered to be necessary during this period. Some additions and extensions of the collection system may be necessary to provide service to new areas of development.

DUTTON

Existing System. Presently the 542 residents are served by an existing community sewer system facility. The collection system is of adequate size to handle present and anticipated future sewage flows. A ten inch outfall line carries the sewage to an existing sewage treatment plant. This outfall line has sufficient capacity to handle the present flows of sewage as well as those anticipated during the twenty year planning period. The existing sewage treatment plant does not result in satisfactory sewage treatment. The community has considered replacing this mechanical treatment plant with new treatment facilities. Plans have been prepared and the necessary application for financial assistance have been submitted and approved so that the new facility can be constructed in the near future.

Improvements Next Five to Ten Years. The population is expected to be 550 by 1975. A six acre wastewater stabilization pond is proposed to replace the present mechanical treatment plant. It is proposed that this facility be constructed during this period.

Improvements by 1990. The estimated 1990 population is 580. The present sewage collection system will adequately serve the needs of this population. The proposed wastewater stabilization pond which is to be constructed during the five to ten year period will adequately serve the needs of this population.

POWER

Existing System. The 125 persons which presently reside in this community use private septic tanks and cesspools for sewage disposal. The soil is a rather tight clay which results in poor drainage for sewage effluent. Most residents have considerable difficulty with the operation of these facilities.

Improvements Next Five to Ten Years. The estimated 1975 population is 130. It is expected that the present use of private septic tanks will adequately serve their needs during this period.

Improvements by 1990. By 1990 the population will have reached 150. It is proposed that a community sewer system facility be constructed during this period. There is sufficient population to justify the construction. It is anticipated that the present operational problems in existence with the private septic tanks will become more apparent as increased water usage occurs. The proposed water system will promote much greater usage of water thereby increasing the operation problems with the existing septic tanks. A proposed layout of the sewer system facility is shown on Map 16. This improvement would result in a facility with adequate capacity to serve their needs throughout the planning period.

PENDROY

Existing System. The forty five persons which presently reside in this community use private septic tanks and cesspools to handle sewage disposal. These facilities reportedly do not present operational problems. It is expected that these facilities will adequately serve their needs throughout the planning period.

BYNUM

Existing System. The estimated 1970 population is forty five. This population will decrease to about thirty seven by 1990. The residents presently use private septic tanks and cesspools for sewage disposal. These systems reportedly provide adequate sewage treatment. The soil is sandy and gravelly and properly constructed drain fields function very satisfactorily. It is expected that these facilities will very adequately serve their needs throughout the planning period.

FARMINGTON

Existing System. The community has a total population of about fifteen. It is expected the population will remain essentially steady throughout the planning period. The residents presently use private septic tanks and cesspools for sewage disposal. There are reportedly no operational problems with these systems. The soil is gravelly and very readily accepts sewage effluent. It is expected that these facilities will adequately serve the needs throughout the planning period.

COLLINS

Existing System. The estimated 1970 population is twenty. The population predictions indicate the population will decrease to ten by 1990. The residents presently use private septic tanks or outhouses for their sanitary disposal facilities. The septic tanks reportedly operate satisfactorily. The septic tanks are considered to be a satisfactory means of sewage disposal for this community.

APPENDIX I.

MONTANA WATER LAW AND WATER QUALITY CRITERIA

SURFACE–WATER LAW

Two basic laws which concern surface-water rights are recognized in the United States. They are the Doctrine of Riparian Rights and the Doctrine of Prior Appropriation. The Doctrine of Riparian Rights originated in England and is in widespread use in the eastern United States. Basically, this doctrine gives the owners of land bordering a stream the right to have that stream flow past their land undiminished in quantity and unaltered in quality and to use it for household and livestock purposes. Under the Riparian Doctrine, the water is restricted to riparian owners, and it is unlawful for them to reduce significantly the flow of the stream.

It was determined early in the history of Montana that the Doctrine of Riparian Rights was unsuited to the conditions here. First, it was obvious that diversion and reduction of stream flow was a necessity to mining and agricultural uses, and second, much of the land in Montana was under public rather than private ownership. The Doctrine of Prior Appropriation was much more suited to the region and was formally adopted by the Montana Supreme Court in 1921. The appropriation right originated in California where the early gold miners diverted water from streams to placer-mine gold. Water rights were considered in the same manner as mining claims; those who were first in time were first in right and the quantity or size of right was determined by the amount beneficially used.

The five basic points of the Doctrine of Prior Appropriation are:

1. The use of water may be acquired by both riparian and non riparian landowners.
2. It allows diversion of water regardless of the reduction of the water supply in the stream.
3. The value of the right is determined by the priority of the appropriation, i.e., first in time is first in right.
4. The right is limited to the use of the water. Stream waters in Montana are the property of the state and the appropriator acquires only a right to their use. Moreover, this use must be beneficial.
5. A right to the use of water is considered property only in the sense that it can be bought or sold; its owner may not be deprived of it except by due process of law.

No water right may be acquired on a stream in Montana without diversion of water and its application to a beneficial use. The method of acquiring or appropriating a right to water has been outlined by the state legislature. The procedure for appropriation from an unadjudicated stream is:

1. Posting of notice in a conspicuous place at the point of intended diversion stating:
   a. quantity of water claimed
   b. use for which water is claimed and place of use
   c. description of means of diversion
   d. date of appropriation
   e. name of appropriator
2. Filing, within twenty days after date of appropriation, of a notice of appropriation with the county clerk including in addition to the posted notice:
   a. name and description of the stream
   b. description of point of diversion with reference to a permanent monument or natural marker
   c. verification by affidavit of the appropriator that facts of the notice are true

Montana laws do not require that a water user file an official record of the completion of an appropriation. It is, therefore, a fact that in many instances the demand for the water of a stream is much greater than the supply available. In such cases there is a means by which the rights and priorities of each user along a specific stream may be officially determined. The action of adjudication or water right suit may be initiated by any one or more of the appropriators. The Judge of the District Court then examines all of the claims and issues a decree establishing priority of right of each water user and the amount of water he is entitled to use.

The procedure for appropriation of water from adjudicated streams is slightly more complicated than that of unadjudicated streams. For adjudicated streams an appropriator shall:

1. Employ a competent engineer to survey the area and means of conducting water from its source to place of intended use.
2. Have aerial photographs and maps thereon to show the course of the intended diversion or location of intended impoundment.
3. File with the Clerk of the Court of the county of appropriation a petition which includes:
   a. the amount of water sought by appropriation
   b. a description of the watercourse or body from which water is intended to be appropriated
   c. a description of the means of diversion or size, location and manner of construction if a reservoir is intended
   d. the engineers survey and aerial photographs
   e. a declaration by the appropriator that the rights sought shall be subject to and bound by any decree theretofore rendered adjudicating the waters or any body to which the waters may be tributory
4. Name all others who have or appear to have rights in the source of supply as defendants in the appropriation proceeding.

Upon completion of the above procedure, a trial is held and normally a decree results. If a new appropriation is granted, the appropriator shall be bound by all prior rights and decrees.

GROUND–WATER LAW

The quantity of ground water stored beneath the surface of the earth in Montana exceeds that on the surface. For many years use of this vast ground-water resource was very limited and no need for regulating its use was deemed necessary. In recent years the use and development of ground-water resources has increased considerably and it was realized that, without some means of regulation, ground water in some areas might be withdrawn at a faster rate than it could be naturally replenished.

In 1961 the 37th Legislative Session of Montana passed a bill which created a Ground Water Code in Montana (Chapter 237, Revised Codes of Montana, 1961). This bill became law on January 1, 1962, and the State Engineer of Montana was designated as the "Administrator."

The Ground-Water Law contains many provisions which are considered pertinent to this comprehensive plan, and, therefore, portions of these provisions will be presented in this report. They are:

Section 1. Definitions or Regulations As Used In The Act.

a. "Ground Water" means any fresh water under the surface of the land including the water under the bed of any stream, lake, reservoir, or other body of surface water. Fresh water shall be deemed to be the water fit for domestic, livestock, or agricultural use. The Administrator, after a notice of hearing, is authorized to fix definite standards for determining fresh water in any controlled ground-water area or sub area of the state.

b. "Aquifer" means any underground geological structure or formation which is capable of yielding water or is capable of recharge.

c. "Well" means any artificial opening or excavation in the ground, however made, by which ground water can be obtained or through which it flows under natural pressures or is artifically withdrawn.

d. "Beneficial use" means by economically or socially justifiable withdrawal or utilizations of water.

e. "Person" means any natural person, association, partnership, corporation, municipality, irrigation district, the State of Montana, or any political sub-division or agency thereof, and the United States or any agency thereof.

f. "Administrator" means State Engineer of the State of Montana.

g. "Ground-Water area" means an area which, as nearly as known facts permit, may be designated so as to enclose a single distinct body of ground water which shall be described horizontally by surface description in all cases and which may be limited vertically by describing known geological formations, should conditions dictate this to be desirable. For purpose of administration, large ground-water areas may be divided into convenient administrative units known as "sub-areas."

Section 2. Right To Use. Rights to surface water where the date of appropriation precedes January 1, 1962, shall take priority over all prior or subsequent ground-water rights. The application of ground water to a beneficial use prior to January 1, 1962, is hereby recognized as a water right. Beneficial use shall be the extent and limit of the appropriative right. As to appropriations of ground water completed on and after January 1, 1962, any and all rights must be based upon the filing provisions hereinafter set forth, and, as between all appropriators of surface or ground water on and after January 1, 1962, the first time is first in right.

Any ground water put to beneficial use after January 1, 1962, must be filed upon in order to establish a water right thereto. Four different types of forms have been provided for filing. The titles of the forms are:

Form No. 1 "Notice of Appropriations of Ground Water"
Form No. 2 "Notice of Completion of Ground Water by Means of a Well"
Form No. 3 "Notice of Completion of Ground Water Appropriation Without a Well"
Form No. 4 "Declaration of Vested Ground Water Rights"

Form No. 1 is optional and Form No. 4 was for those who had put ground water to a beneficial use before January 1, 1962. Again, it is important to recognize that the ground-water law states especially that, "Until a notice of completion (Form No. 2 or No. 3) is filed with respect to any use of ground water instituted after January 1, 1962, no right to that use of water shall be recognized."

WATER QUALITY

The State Department of Health, under the supervision of the State Water Pollution Control Council, is responsible for administering the water pollution laws of the state. As stated in the resume of Montana water laws published by the Montana Water Resources Board, "the Department of Health has superivsion over all state waters which are directly or indirectly being used as a public water supply." The Water Pollution Control Council is responsible for classifying water and formulating a program for pollution control.

The Water Pollution Control Council has adopted specific "Water Quality Criteria;" established "Water Use Classifications;" and issued a complete list of "Policy Statements." The original adoption of these standards took place October 5, 1967, and since that time they have been made available to interested persons by the State Department of Health. A portion of the information available from the Department is the detailed chemical, physical, and biological standards of the "Water Quality Criteria" for effluent water. Water quality standards for domestic water, as set forth by the United States Public Health Service, are shown in Table A. The Montana Water Pollution Control Council "Policy Statements" and "Water Use Classifications" are presented in the following paragraphs.

The Water Pollution Control Council has added a new policy statement at the request of the Federal Water Pollution Control Administration. The new statement is:

> *Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at*

the high quality unless it has been affirmatively demonstrated to the state that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the necessary degree of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be kept advised in order to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

The originally adopted "Policy Statements" are:

1. *Quality of waters classified for multiple use shall be governed by the most stringent criteria listed for any use.*
2. *The Council has classified as "A–Closed" only those waters on which access and other activities are presently controlled by the utility owner. If other uses are permitted by the utility owner, these waters shall be reclassified "A–Open" or lower. Conversely, waters in the "A–Open" classification, if shown to meet the "A–Closed" criteria, may be so classified by the Council at the request of the utility owner.*

   Where "A–Open" water is used for swimming and other water contact sports, a higher degree of treatment may be required for potable water use.
3. *The water quality standards are subject to revision (following public hearings and, in the case of interstate streams, concurrence of the Federal Water Pollution Control Administration) as technical data, surveillance programs and technological advances make such revisions desirable. There are waters in the state on which little water quality data is presently available. Water quality criteria for these waters was established to protect existing and future water uses on the basis of the most representative information available.*

   In some cases, particularly in eastern Montana, waters have been classified "B" and "C" where the upper ends of the streams will probably be suitable for this use while the lower ends will not. However, not enough data is available to determine where the "B" and "C" designation should be dropped. Whenever a water supply or swimming area is developed, the regulations and the advice of the State Board of Health should be acquired. As time permits, data will be obtained and the classifications reviewed.
4. *As used in the Water Quality Criteria, the phrases "natural," "naturally present" and "naturally occurring" are defined as conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Waters below existing dams will be considered natural.*
5. *It is the intent of the criteria that the increase allowed (temperature for example) above natural conditions is the total allowable from all waste sources along the classified stream.*
6. *Although the water quality criteria specify minimum dissolved oxygen concentrations, it shall be the policy of the Council to require the best practicable treatment or control of all oxygen-consuming wastes in order to maintain dissolved oxygen in the receiving waters at the highest possible level above the specified minimums.*
7. *For treatment plant design purposes, stream flow dilution requirements shall be based on the minimum consecutive seven day average flow which may be expected to occur on the average once in ten years.*
8. *Where sampling stations and points of mixing of discharges with receiving waters as mentioned in the water quality criteria are to be established on interstate waters, the concurrence of the Federal Water Pollution Control Administration will be solicited.*

TABLE A
Water Quality Standards

Characteristic	Permissible Concentrations in Milligrams Per Liter	Objections to Concentrations Beyond Permissible Limits
Turbidity	5*	Esthetic
Color	15*	Esthetic
Threshold Odor Number	3*	Esthetic
Alkyl Benzene Sulfonate (ABS)	0.5	Taste, Foaming, Indicator of Pollution
Arsenic (As)	0.01	Toxic
Chloride (Cl)	250	Possible Laxative Effect
Copper (Cu)	1.0	Possible Physiological Effect
Carbon Chloroform Extract (CCE)	0.2	Toxicological Interest
Cyanide (CN)	0.01	Toxic
Fluoride (F)	See Below	Mottling of Teeth
Iron (Fe)	0.3	Esthetic, Staining of Laundry
Manganese (Mn)	0.05	Esthetic, Staining of Laundry
Nitrate	45	Methemoglobinemia
Phenols	0.0001	Taste
Sulfates	250	Possible Laxative Effect
Total Dissolved Solids	500	Possible Laxative Effect
Zinc (Zn)	5	Possible Laxative Effect
Radium-226	3**	Radiation Damage
Strontium-90	10**	Radiation Damage
Gross Beta Radioactivity	1,000**	Radiation Damage

Concentrations in excess of following should be re-examined before use (mg/l):

Arsenic (As)	0.05	Fluoride (F)	See Below
Barium (Ba)	1.0	Lead (Pb)	0.05
Cadmimum (Cd)	0.01	Selenium (Se)	0.01
Hexavalent Chromium (+6)	0.05	Silver (Ag)	0.05
Cyanide (CN)	0.2		

Annual Average of Maximum Daily Air Temperature	Recommended Control Limits—Fluoride Concentrations in mg/l		
	Lower	Optimum	Upper
50.0 to 53.7	0.9	1.2	1.7
53.8 to 58.3	0.8	1.1	1.5
58.4 to 63.8	0.8	1.0	1.3
63.9 to 70.6	0.7	0.9	1.2
70.7 to 79.2	0.7	0.8	1.0
79.3 to 90.5	0.6	0.7	0.8

Hardness Standards for Water

Hardness in Milligrams per Liter	Degree of Hardness
0 - 35	Soft
36 - 100	Medium
100 - 150	Hard
Over 150	Extremely Hard

* Standard Units. ** Pico-curies Per Liter.

Source: Ameen, Joseph S., Community Water Systems, 1960

9. *It is not the intent of these criteria to provide for a swimming water immediately below an existing treated domestic sewage outfall.*
10. *Where common treatment is practicable, it is the policy of the Council to restrict the number of sewer outfalls to a minimum.*
11. *Tests or analytical procedures to determine compliance with standards will, insofar as practicable and applicable, be made in accordance with the methods given in the twelfth edition of "Standard Methods for the Examination of Water and Waste Water" published by the American Public Health Association, et al., or in accordance with tests or analytical procedures that have been found to be equal or more applicable.*
12. *Because of conflicting testimony, it is the intent of the Water Pollution Control Council to obtain additional information on temperatures and fisheries on waters below existing steam generating stations at Billings and Sidney on the Yellowstone River. This can probably be best accomplished by a cooperative study between the utility, State Fish and Game Department, Federal Water Pollution Control Administration and the Montana State Department of Health.*
13. *Insufficient information is available for establishing fixed sediment criteria at this time. Until standards can be set, reasonable measures, as defined by the Water Pollution Control Council, must be taken to minimize sedimentation from man's activities.*

Minimum treatment requirements set forth by the Council are:

1. *Domestic Sewage – the minimum treatment required for domestic sewage shall be secondary treatment or its equivalent with the understanding that properly designed and operated sewage lagoons will meet this requirement.*
2. *Industrial Wastes – the minimum treatment required for industrial wastes shall be secondary treatment or its equivalent.*

Definitions of the water use classifications assigned to the Columbia and Missouri Basins and the Hudson Bay drainage in Montana are:

"A–Closed" – Water supply for drinking, culinary and food processing purposes, suitable for use after simple disinfection. Public access and activities such as livestock grazing and timber harvest should be strictly controlled under conditions prescribed by the State Board of Health.

The Council has classified as "A–Closed" only those waters on which access is presently controlled by the utility owner. If other uses are permitted by the utility owner, these waters shall be reclassified "A–Open–D_1" or lower.

"A–Open–D_1" – Water supply for drinking, culinary and food processing purposes suitable for use after simple disinfection and removal of naturally present impurities. Water quality shall also be maintained suitable for the use of these waters for bathing, swimming and recreation (See "Note" below), (where these waters are used for swimming and other water contact sports, a higher degree of treatment may be required for potable water use); growth and propagation of salmonid fishes and associated aquatic life, water fowl and furbearers; agricultural and industrial water supply. Therefore, these waters shall be held suitable for "A–Open", "C", "D", "E" and "F" uses but may not necessarily be used for all such purposes.

Note: Common sense dictates that swimming and other water contact sports are inadvisable with a reasonable distance downstream from sewage treatment facility outfalls.

Waters in this class, if shown to meet the "A–Closed" criteria, may be so classified by the Council at the request of the utility owner.

All waters within the boundaries of national parks and nationally designated wilderness, wild or primitive areas in Montana are classified "A–Open–D$_1$" except those adjacent to developed areas such as Snyder Creek through the community of Lake McDonald and Swiftcurrent Creek below the Many Glacier Chalet, both in Glacier National Park. Also, Georgetown, Flathead and Whitefish Lakes and Lake Mary Ronan are classified as "A–Open–D$_1$" as are some streams presently used for domestic water supply.

"B–D$_1$" The quality of these waters shall be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming, and recreation (see note under "A–Open–D$_1$"); growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural and industrial water supply. Therefore, "B–D$_1$" equals "B", "C", "D$_1$", "E" and "F".

"B–D$_2$" The quality of these waters shall be maintained suitable for the uses described for "B–D$_1$" waters except that the fisheries use shall be described as follows:

> *"Growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers."*

Therefore, "B–D$_2$" equals "B", "C", "D$_2$", "E" and "F".

"B–D$_3$" The quality of these waters shall be maintained suitable for the uses described for "B–D$_1$" waters except that the fisheries use shall be described as follows:

> *"Growth and propagation of non-salmonid fishes and associated acquatic life, waterfowl and furbearers."*

Therefore, "B–D$_3$" equals "B", "C", "D$_3$", "E" and "F".

"C–D$_2$" The quality of these waters shall be maintained suitable for bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural and industrial water supply. Therefore, "C–D$_2$" equals "C", "D$_2$", "E" and "F".

"D$_2$" The quality of these waters shall be maintained for growth and marginal propagation of salmonid fishes and associated aquatic life, water fowl and furbearers; agricultural and industrial water supply. Therefore, "D$_2$" equals "D$_2$", "E" and "F".

"E" The quality of these waters shall be maintained for agricultural and industrial water supply uses and "E" shall equal "E" and "F" uses.

"F" The quality of these waters shall be maintained suitable for industrial water supply uses, other than food processing.

Sources:
1. "Montana Water Laws: A Resume," Inventory Series Report No. 5, Montana Water Resources Board, Helena, Montana, November, 1968
2. "Water Resources Survey," Flathead and Lincoln Counties, Montana, State Engineer's Office, Helena, Montana, June, 1965
3. "Water Quality Criteria," "Water Use Classifications," "Policy Statements," communication from Claiborne W. Brinck, Director, Division of Environmental Sanitation, State Department of Health, Helena, Montana, May 7, 1968

APPENDIX II.

COMMUNITY WATER SYSTEM FACILITIES

ANALYSIS CRITERIA

Complete designs of safe community water systems can become extremely complicated. Each design and analysis is usually a unique problem for that individual system. For this study, a general approach must be used; however, it is realized that a more detailed study may result in somewhat different findings and proposals. The following paragraphs contain a discussion of the approach used in arriving at general design criteria used herein.

In the analysis and design of water systems, the interrelations of supply, transmission, storage, and distribution must be considered. For example, if the water supply is not adequate to meet the peak hourly demand, storage is necessary to provide a reserve for the peak periods. The size of the various portions of the system is determined by establishing the average daily demand on the system.

The determination of daily water consumption is arrived at by considering records of existing systems. Usage varies over a wide range of about one hundred gallons per capita per day (gpcpd) to six hundred gpcpd. Usages of four hundred gpcpd are very common during hot weather. The basis of analysis used, herein, is two hundred gpcpd average. The accepted nationwide average daily demand value for a community water system is 125 gallons per day per person for domestic use. Records show that practically all Montana communities exceed this amount especially during hot weather, and the two hundred gpcpd is more in line with present day demands for communities in Montana.

Well capacities and capacities of other sources of supply must be sufficient to provide water for the average requirements and additional amounts to sustain peak periods. It is felt that a water source capable of supplying the total average daily demand by operating for a twelve hour period is a suitable basis for analysis. This means that the average daily demand doubled, divided by twenty four hours per day and sixty minutes per hour, will result in a required rate of supply in gallons per minute. It is realized that this source may be required to operate more than twelve hours during high demand periods. This freedom in operation, combined with storage facilities, is intended to provide the necessary flexibility to handle low and high demand periods economically.

It is common practice to provide storage facilities with capacity equal to the supply necessary for one average day. This will provide storage for fire protection and any excess will add to the flexibility of the system. Table B shows desired storage for fire based on population. This information corresponds to requirements of the Montana Fire Rating Bureau and is taken from "Community Water Supplies" by Ameen.

During certain times of the year water consumption will exceed the average figure of two hundred gpcpd. The system analysis must be checked to determine the amount of water actually available to supply such demands. The estimated 1990 population is used for this check so that population increases are considered. Also, it is expected that the source will have to operate for more than the twelve hour period and any storage in excess of the recommended reserve for fire will be available for domestic consumption. The recommended storage for fire is shown in Table B.

It is considered that the source must produce water for an eighteen hour period. This value, times the well yield, results in a value for the amount of water that can be put into service per day. Also included is the storage not required for fire reserve. The sum of those two values divided by the 1990 population, yields the water available in gallons per capita per day. If water demand exceeds this amount, meters or some other means of controlling water usage must be employed. The above approximate approach results in an adequate amount of water being available and is considered to be the general analysis criteria which is applicable for all the communities studied.

Summary of Analysis Criteria

Average Daily Water Consumption (gpcpd)	200
Desired Output of System (gpcpd)	400
Desired Yield of Source (gpm)	$1.5 \text{ to } 2.0 \times \frac{\text{Average Daily Consumption}}{24 \text{ Hour/Day} \times 60 \text{ Minute/Hour}}$
Desired Storage	One Average Day's Supply

TABLE B

Desired Storage For Fire

Population	Storage (Gals.)	Population	Storage (Gals.)
200	26,800	2,200	92,800
400	33,400	2,400	99,400
600	40,000	2,600	106,000
800	46,600	2,800	112,600
1,000	53,200	3,000	119,200
1,200	59,800	3,500	135,800
1,400	66,400	4,000	152,400
1,600	73,000	4,500	169,000
1,800	79,600	5,000	185,600
2,000	86,200	5,500	202,200

Source: "Community Water Systems" by Ameen.

APPENDIX III.

COMMUNITY SEWER SYSTEM FACILITIES

ANALYSIS CRITERIA

The Montana State Department of Health has adopted the "Ten State Standards" as the criteria for the design of the various elements of the sewer system. Proposals contained herein are based on the recommendations of these standards.

Wastewater stabilization ponds are considered to be the most suitable means of sewage treatment for most smaller communities. The recommended sizes are derived from the criteria of one acre per one hundred population. This criteria is adequate if normal domestic sewage is encountered for all cases; however, more detailed study and analysis is required for final design.

Sewage collection and outfall mains are to be a minimum of eight inches in diameter according to the "Ten State Standards". This minimum is established since reasonably maintenance free systems will result. In many small communities, the sewage flow does not justify this size; however, the possibility of plugging is minimized.

Capacities for the various size lines are determined for minimum grades with the pipe flowing two thirds full and are shown in Table C. Where sewage force mains are required, a minimum of four inch pipe is proposed. Larger lines are sized according to anticipated flow.

Criteria for the sewage flows used in this study are as follows:

Average sewage flow	100 gpcpd
Peak sewage flow (laterals)	400 gpcpd
Peak sewage flow (trunk and outfall)	250 gpcpd
Treatment facilities	100 gpcpd

The nominal determination of pond size is based on the following:

$$\frac{100 \text{ gpcpd} \times 180 \text{ day stor.} \times 7.5 \text{ gal/cu ft}}{5\text{–ft water depth} \times 43{,}560 \text{ sq ft/acre}} = \frac{\text{one acre per}}{100 \text{ people}}$$

TABLE C

Average Capacity of Lines*

Pipe Diameter (inches)	Average Flow (gpm)	Population Equivalent (400 gpcpd flow)
6	110	390
8	200	720
10	320	1,150
		(250 gpcpd flow)
12	510	2,920
15	780	4,480
18	1,080	6,220
24	1,870	10,800

* Flowing two thirds full at minimum grade

PREFACE

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use was obtained by field surveys, supplemented and checked by aerial photography during 1969 and 1970.

Water and sewer system maps show existing facilities for individual towns and communities except when the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of the line and not its precise location. The size of lines, obtained from the most current information available, are indicated when possible. The location of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

GLACIER COUNTY

MAP INDEX

GLACIER COUNTY

Map 1 Topography
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Map 3 Land Ownership
Map 4 Soils

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Map 7 Browning
Map 8 East Glacier
Map 9 Santa Rita
Map 10 Babb
Map 11 St. Mary
Map 12 Blackfoot

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Map 16 East Glacier
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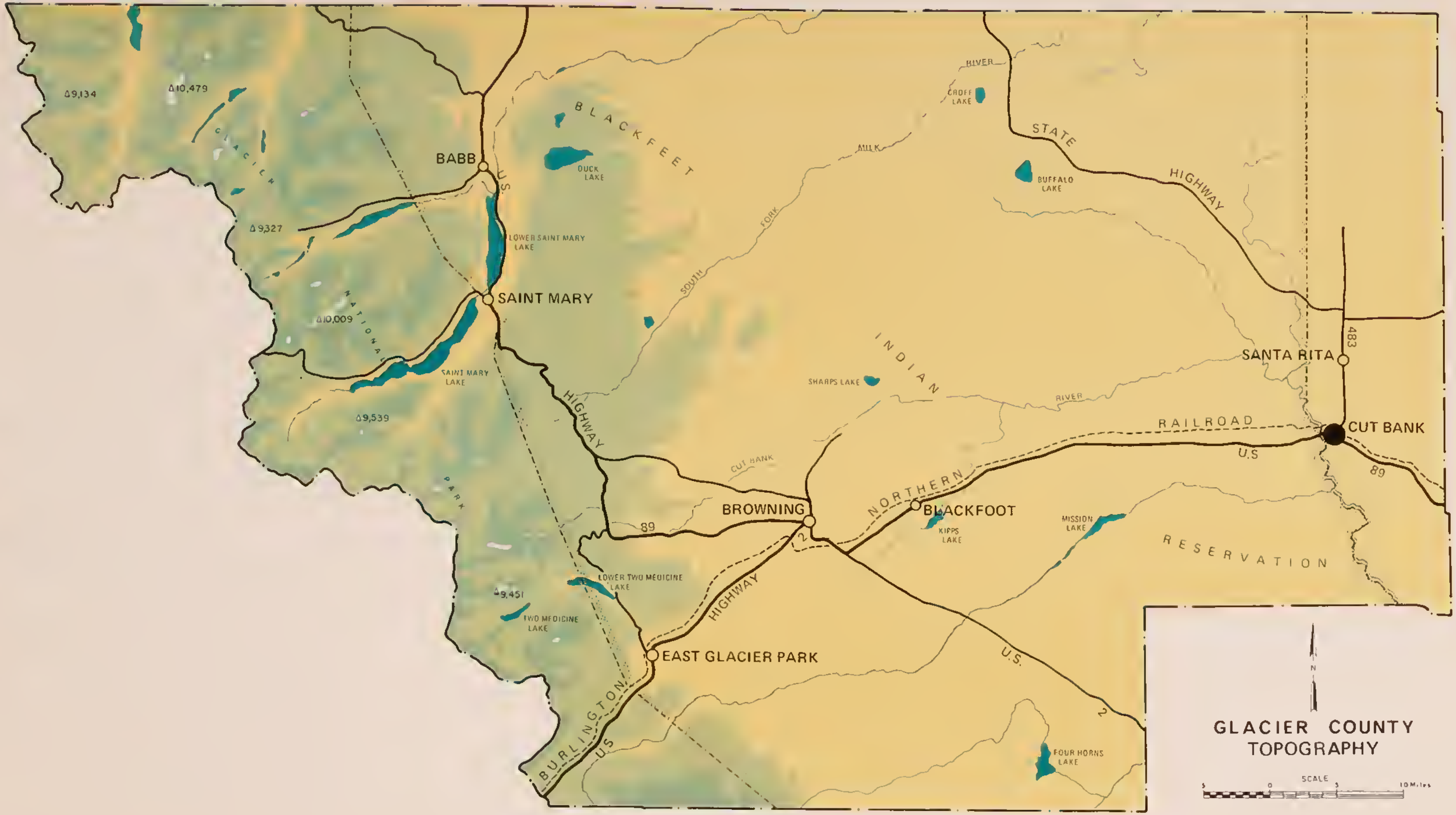
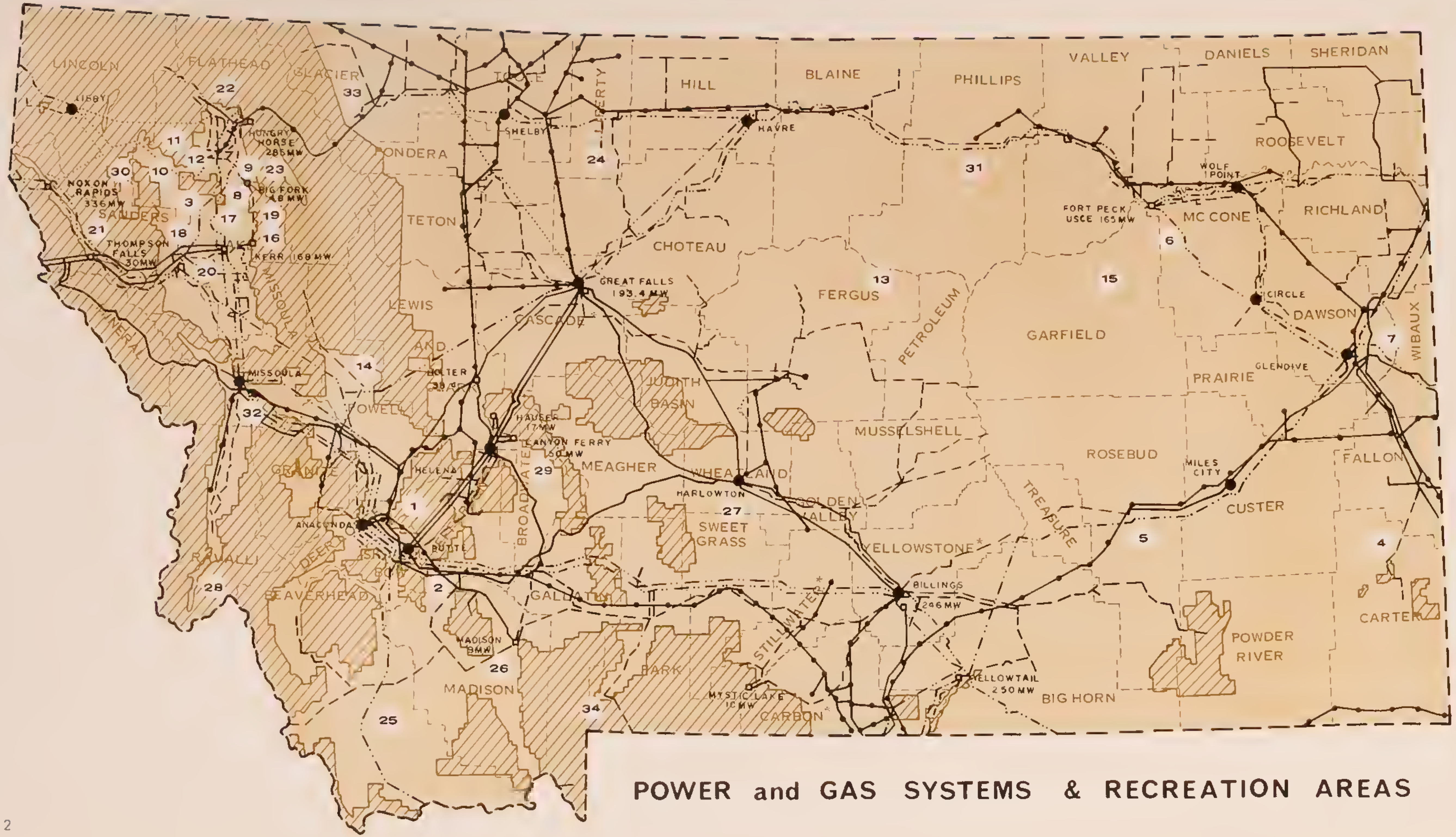


GLACIER COUNTY
TOPOGRAPHY

MAP 1



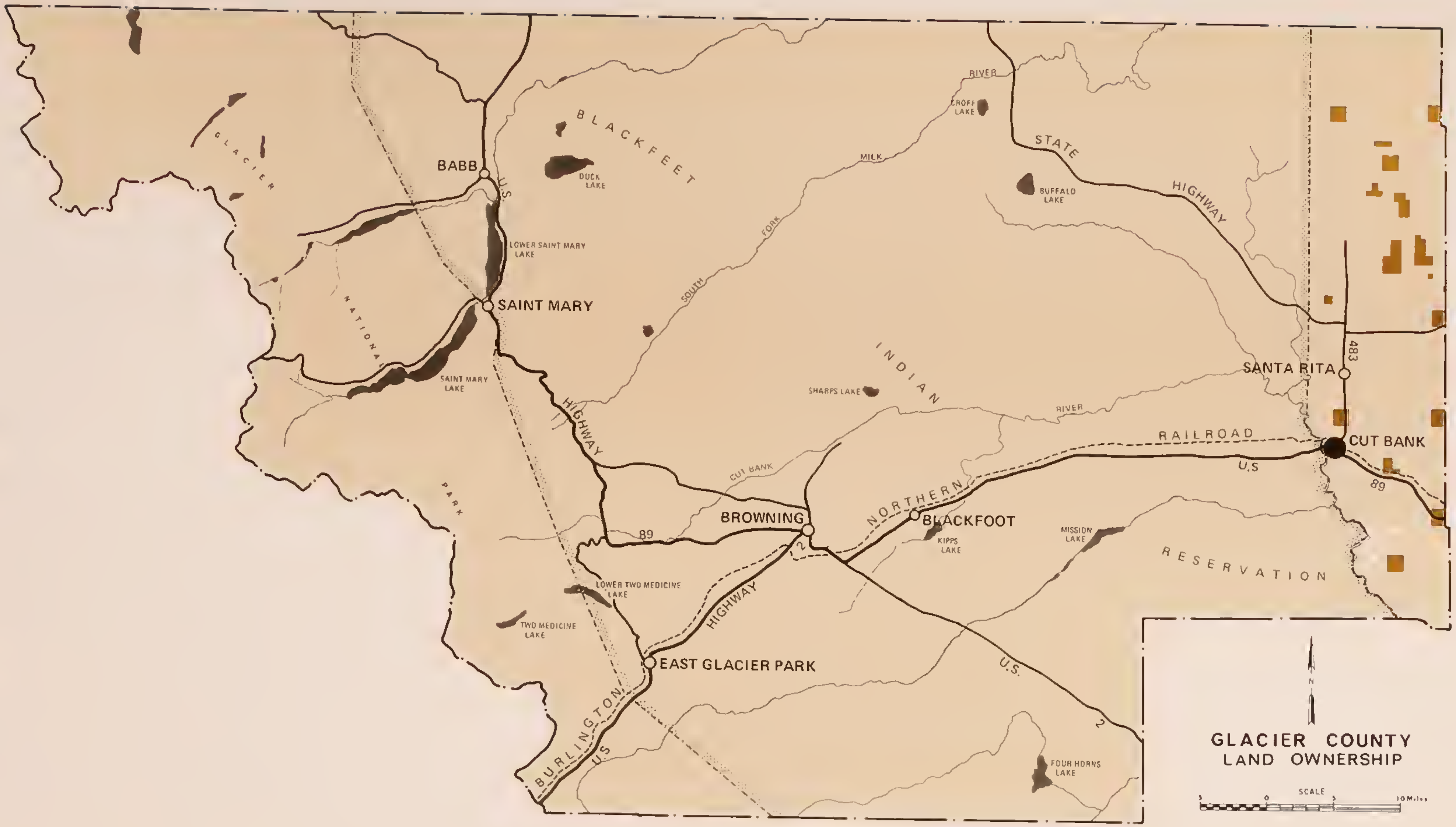
MAP 2

POWER and GAS SYSTEMS & RECREATION AREAS

COUNTY MAP
GENERAL RELIEF

LEGEND

- ● CITIES-TOWNS
- ○ COUNTY SEAT
- ROADS-HIGHWAYS: STATE HIGHWAY, U. S. HIGHWAY
- RAILROADS
- STREAMS-LAKES
- COUNTY BOUNDARY
- INDIAN RESERVATION
- 🟨 0-3,000 FT. ELEVATION
- 🟩 3-5,000 FT. ELEVATION
- 🟩 5-7,000 FT. ELEVATION
- ☐ OVER 7,000 FT. ELEVATION



GLACIER COUNTY
LAND OWNERSHIP

MAP 3

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

☐ POWER PLANT (IN MEGAWATTS)
---- 1 to 50 KILOVOLTS
—— 51 to 100 KILOVOLTS
-·-·- 101+ KILOVOLTS
····· PROPOSED LINES
—•—• GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
2. LEWIS AND CLARK CAVERNS STATE PARK
3. LAKE MARY RONAN STATE PARK
4. MEDICINE ROCKS STATE PARK
5. ROSEBUD STATE PARK
6. ROCK CREEK STATE PARK
7. MAKOSHIKA STATE PARK
8. WEST SHORE STATE PARK
9. WOODS BAY STATE PARK
10. BITTERROOT LAKE STATE PARK
11. ASHLEY LAKE STATE PARK
12. LONE PINE STATE PARK
13. JAMES KIPP STATE PARK
14. HOOPER MEMORIAL STATE PARK
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16. FINLEY POINT STATE PARK
17. ELMO STATE PARK
18. FLATHEAD LAKE STATE PARK
19. YELLOW BAY STATE PARK
20. WALSTAD MEMORIAL PARK
21. THOMPSON FALLS STATE PARK
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23. WAYFARERS RECREATION AREA
24. TIBER RESERVOIR RECREATION AREA
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27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
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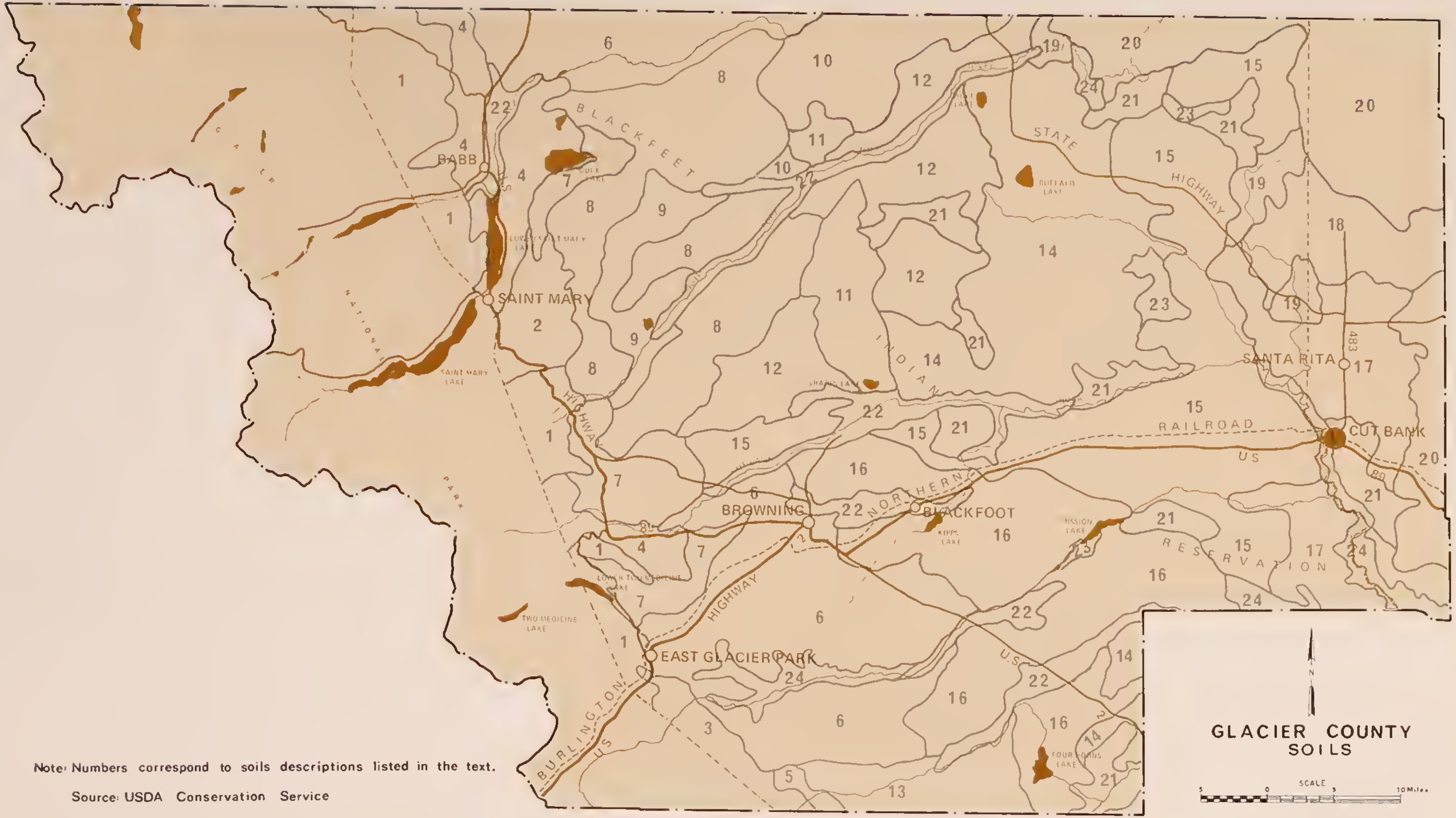
30. LOGAN PARK RECREATION AREA
31. NELSON RESERVOIR RECREATION AREA
32. BEAVERTAIL HILL RECREATION AREA
33. GLACIER NATIONAL PARK
34. YELLOWSTONE NATIONAL PARK

▨ NATIONAL FORESTS



GLACIER COUNTY SOILS

Note: Numbers correspond to soils descriptions listed in the text.

Source: USDA Conservation Service

MAP 4

COUNTY MAP LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS
STATE HIGHWAY U.S. HIGHWAY

RAILROADS

STREAMS-LAKES

COUNTY BOUNDARY

INDIAN RESERVATION

PRIVATELY OWNED LAND

STATE OWNED LAND

FEDERAL OWNED LAND

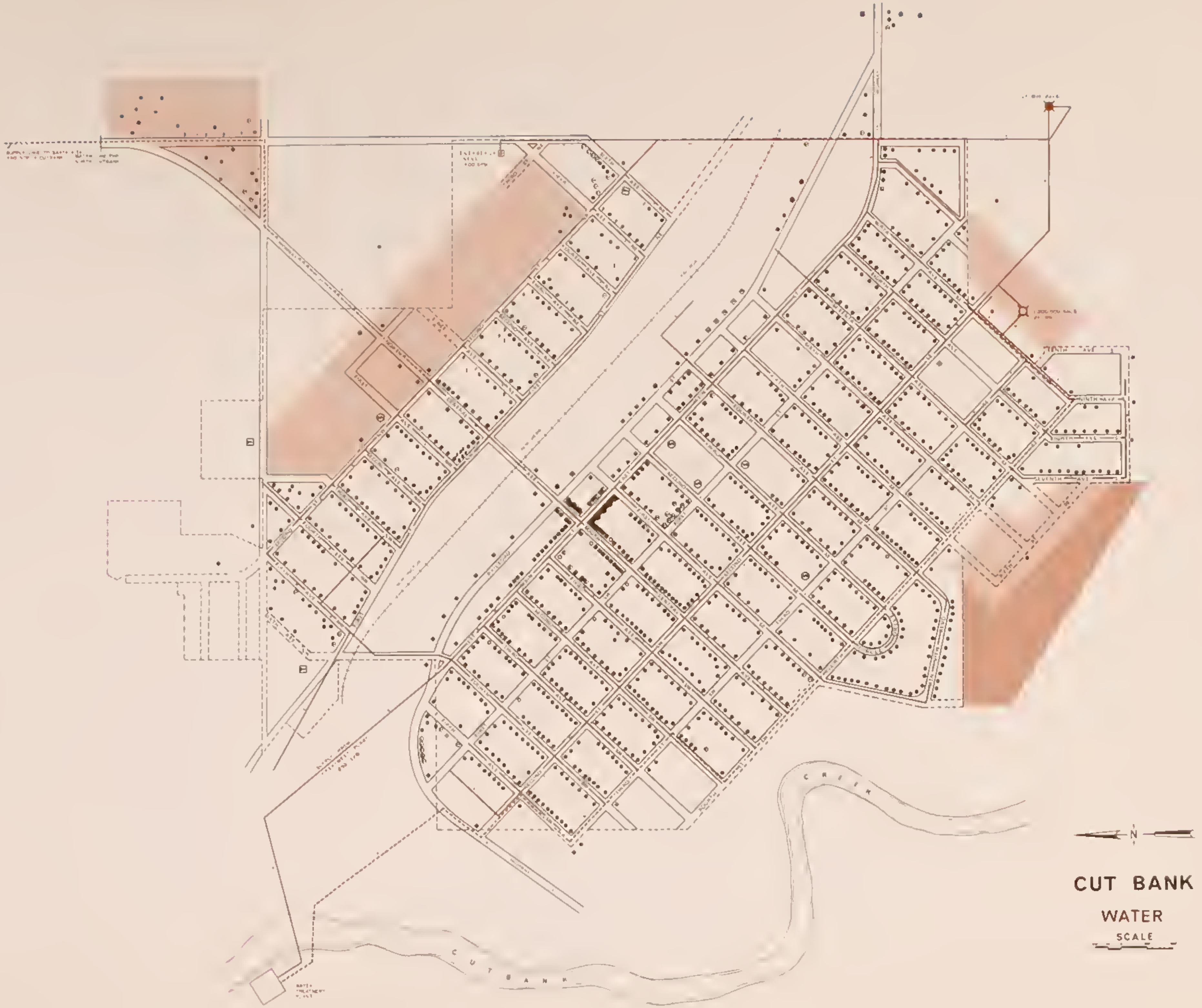
CITIES MAP LEGEND

LAND USE

●	SINGLE RESIDENCE
◒	DILAPIDATED RESIDENCE
Ⓣ	SINGLE TRAILER RESIDENCE
⊕	MULTIPLE RESIDENCE
○	APARTMENTS
🅃	TRAILER COURT
■	COMMERCIAL BUILDING
◪	HOTEL-MOTEL
△	PUBLIC BUILDING
⬡ S	SCHOOL
⬢	CHURCH
⊞	HOSPITAL
✹	INDUSTRIAL
🄴	GRAIN ELEVATOR

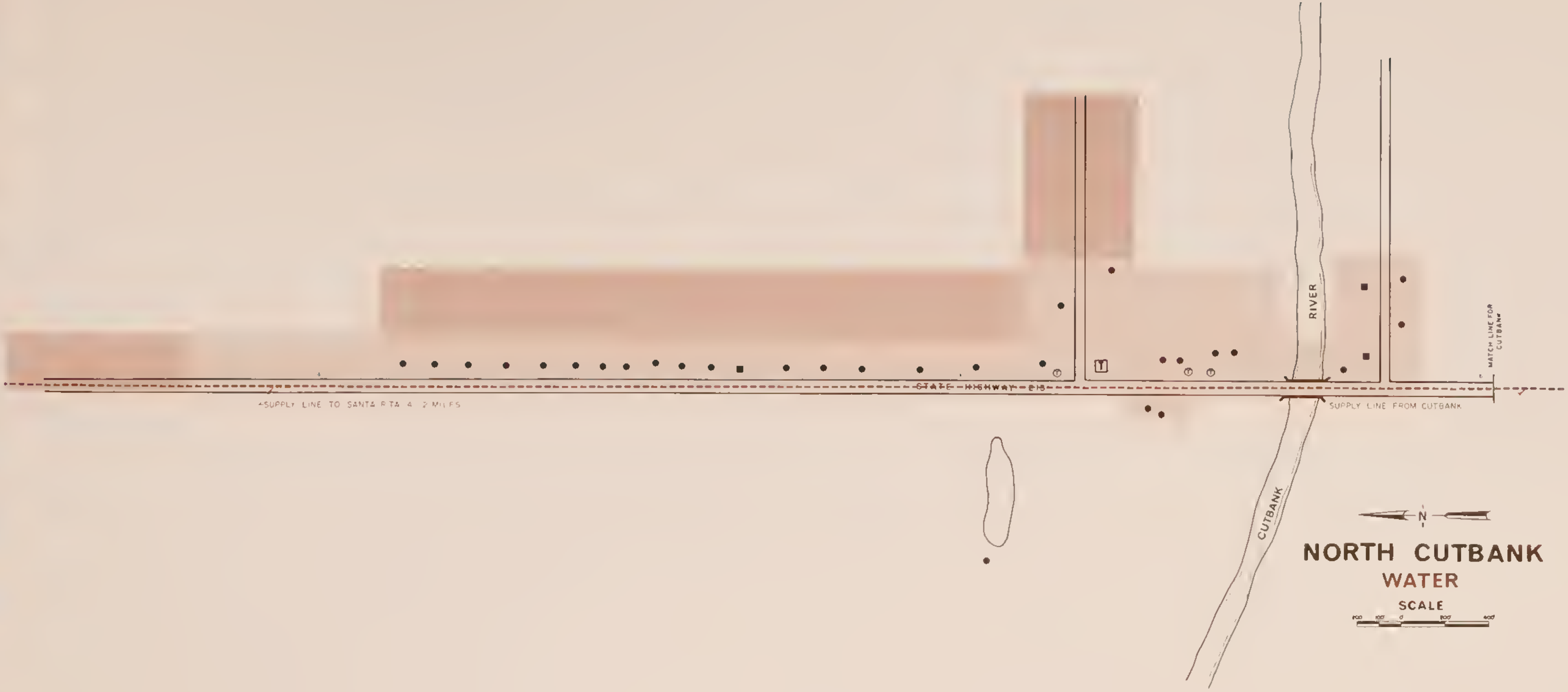
WATER and SEWER SYSTEMS

—6—	EXISTING LINES AND SIZES
- - - - - -	PROPOSED LINES 5-10 YEAR
··············	PROPOSED LINES 10-20 YEAR
—◀—	EXISTING LIFT STATION
- - -◁- - -	PROPOSED LIFT STATION
●	EXISTING WATER STORAGE TANK
¤	PROPOSED WATER STORAGE TANK
—⊡	EXISTING WATER SOURCE
- - ⊡	PROPOSED WATER SOURCE
—□	EXISTING TREATMENT FACILITIES
- - -□	PROPOSED TREATMENT FACILITIES
▭	SERVICE AREA 1970-1980
▨	SERVICE AREA BY 1990



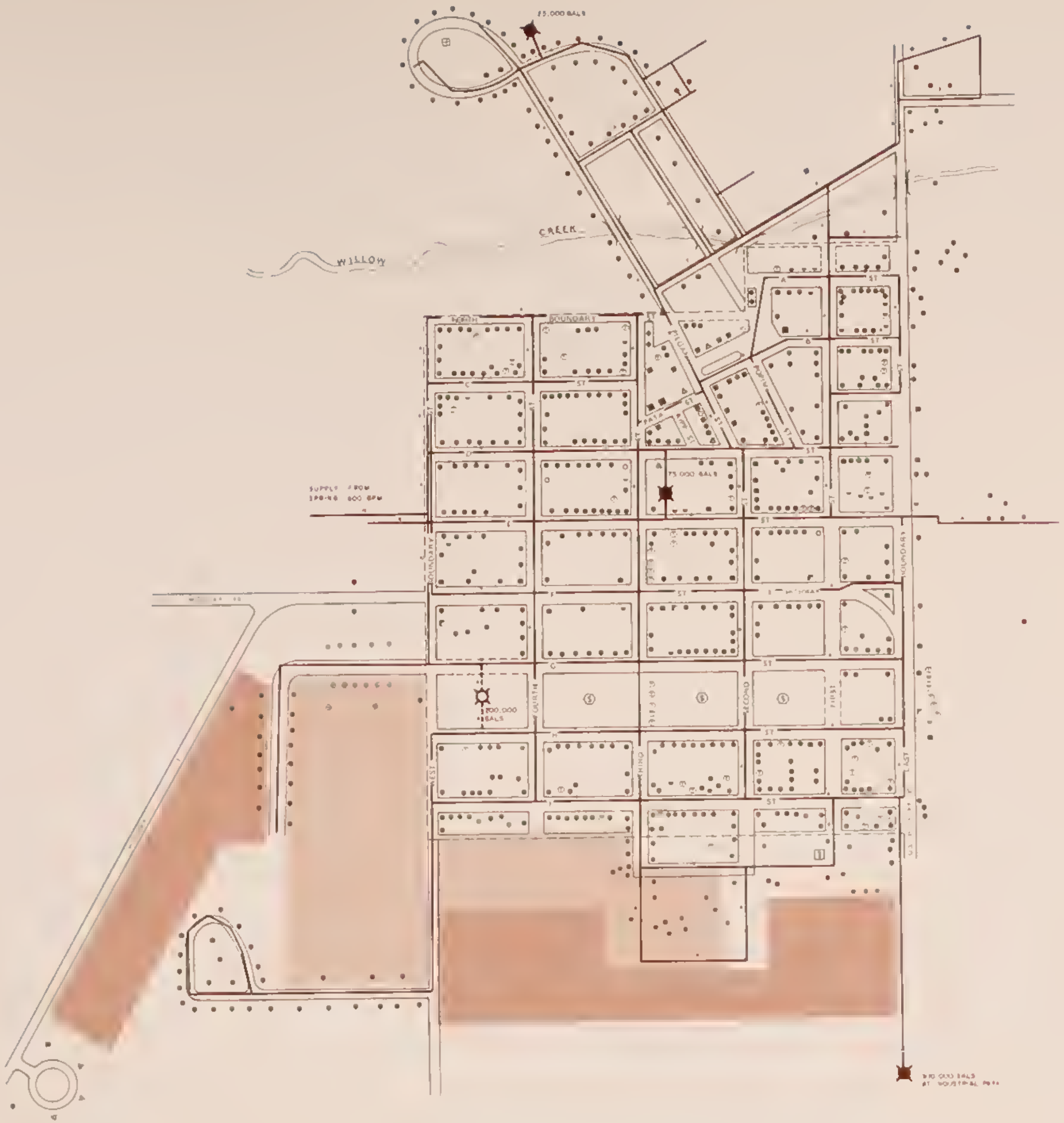
CUT BANK
WATER
SCALE

MAP 5



NORTH CUTBANK
WATER

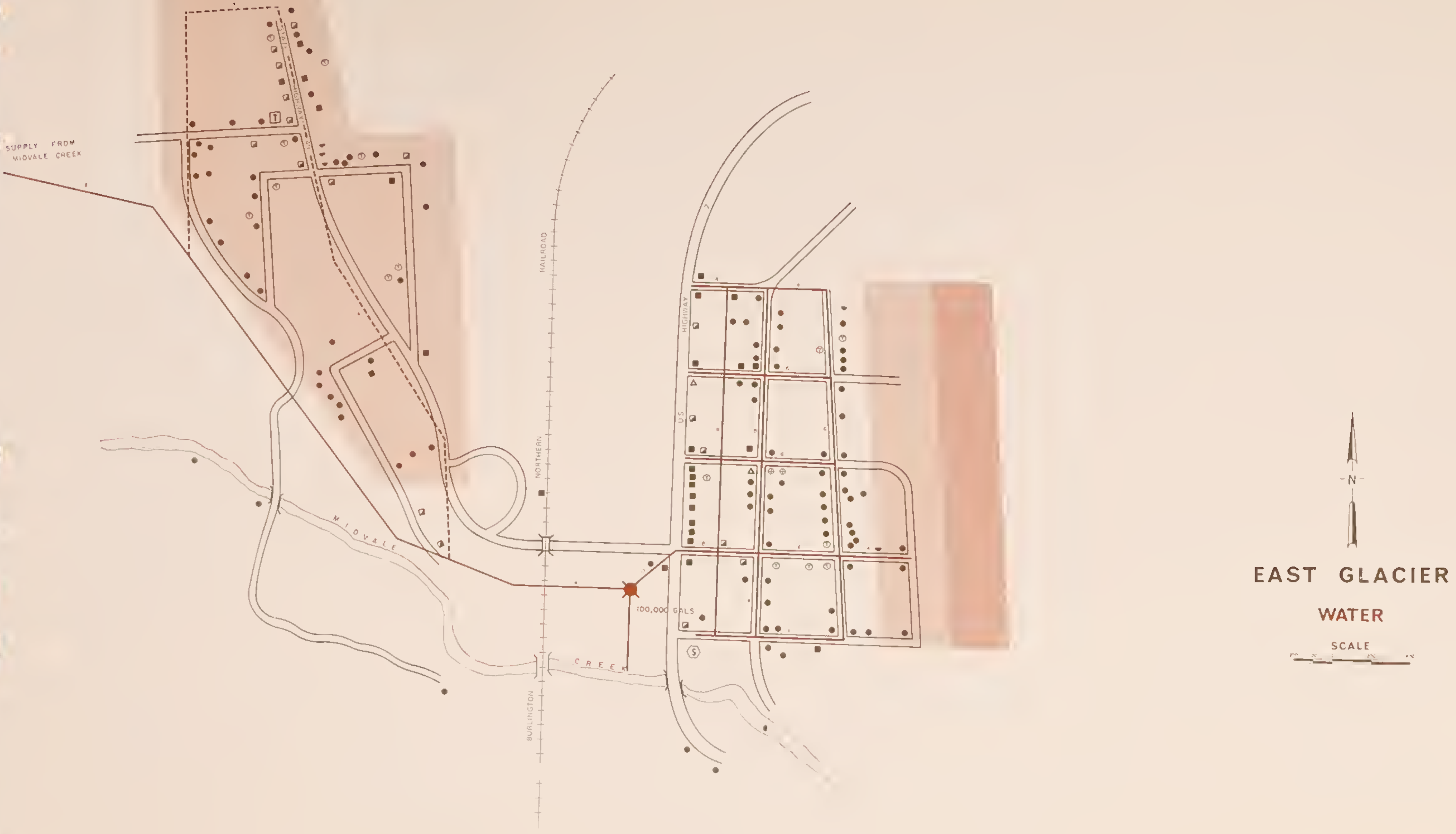
MAP 6



BROWNING
WATER

SCALE

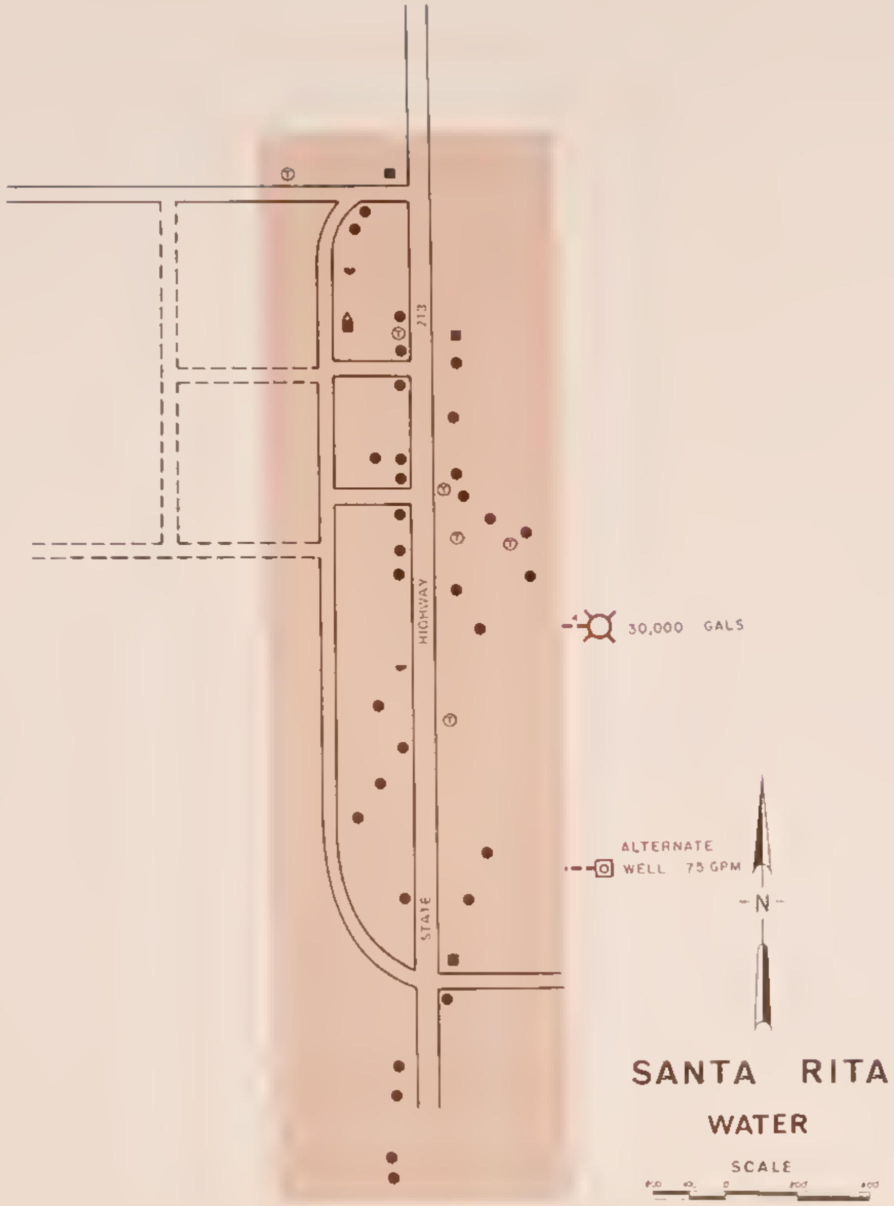
MAP 7



EAST GLACIER

WATER

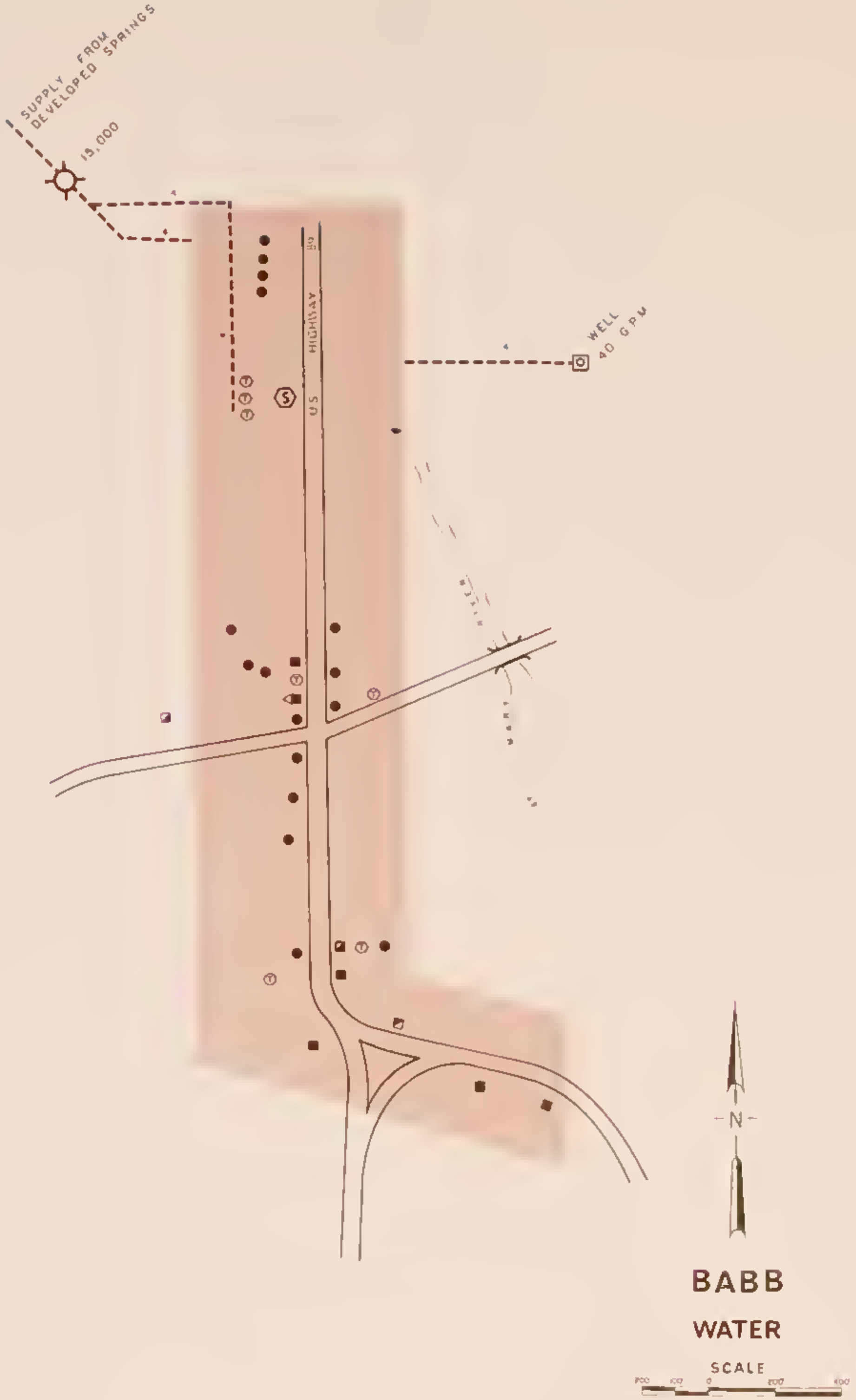
MAP 9



SANTA RITA

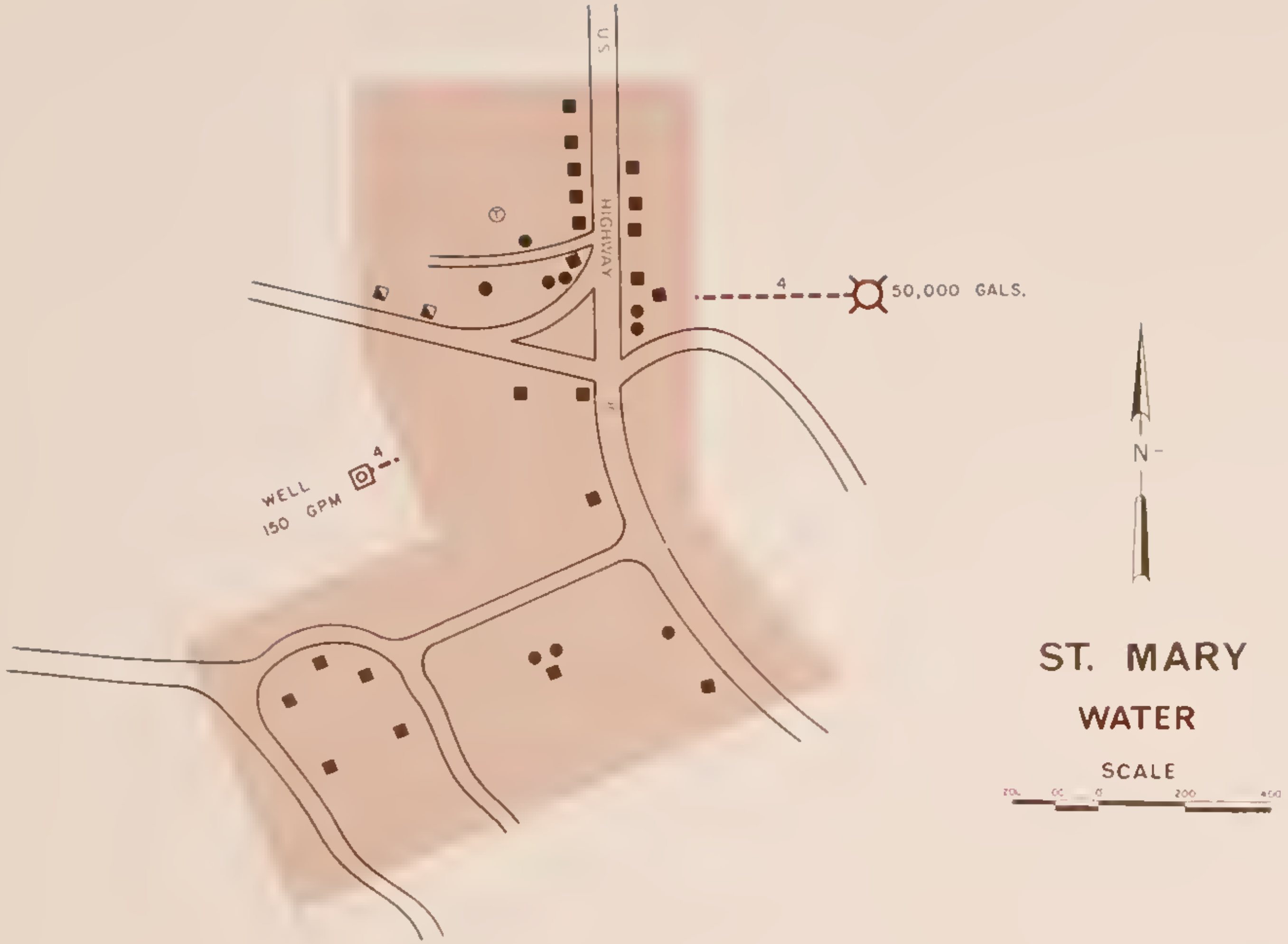
WATER

MAP 10



BABB

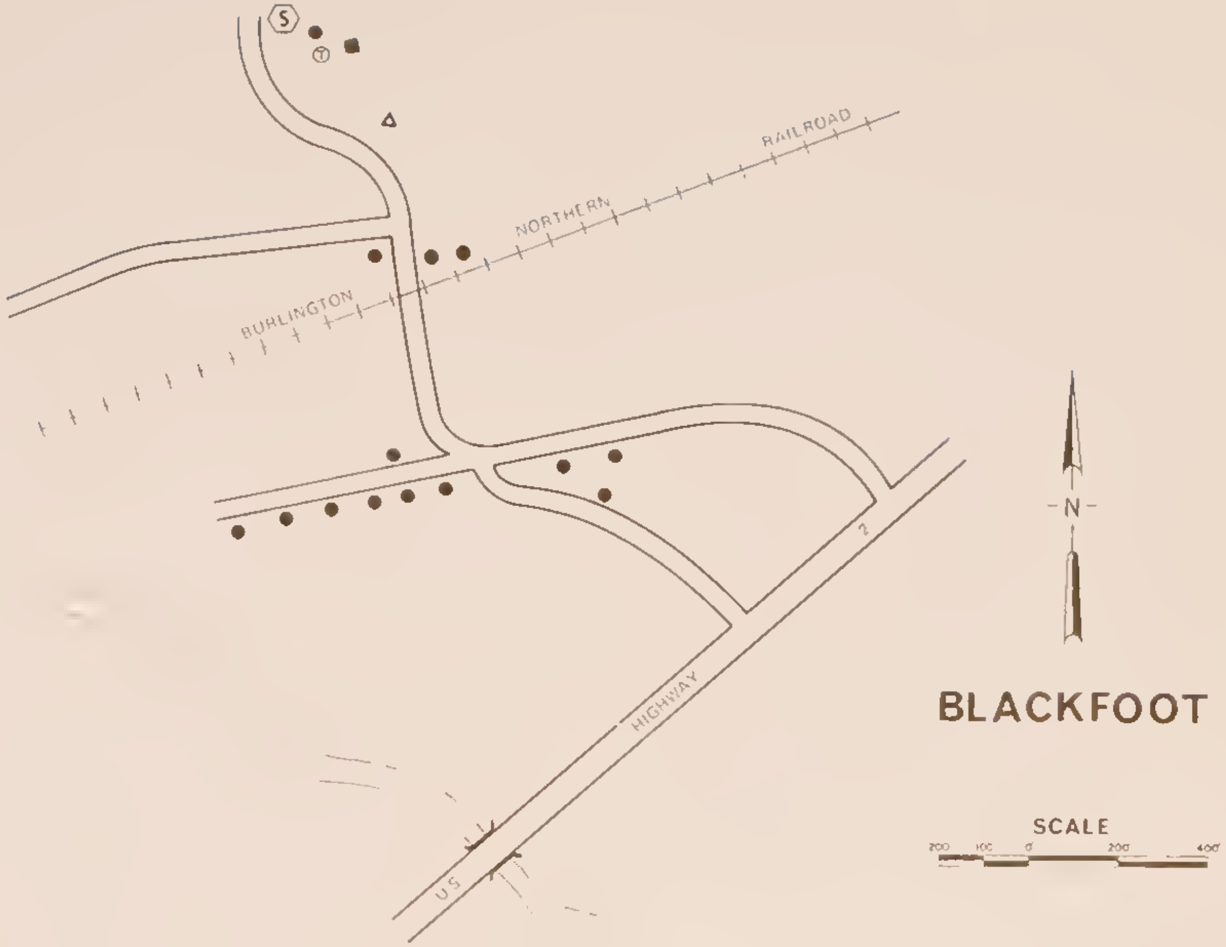
WATER



ST. MARY

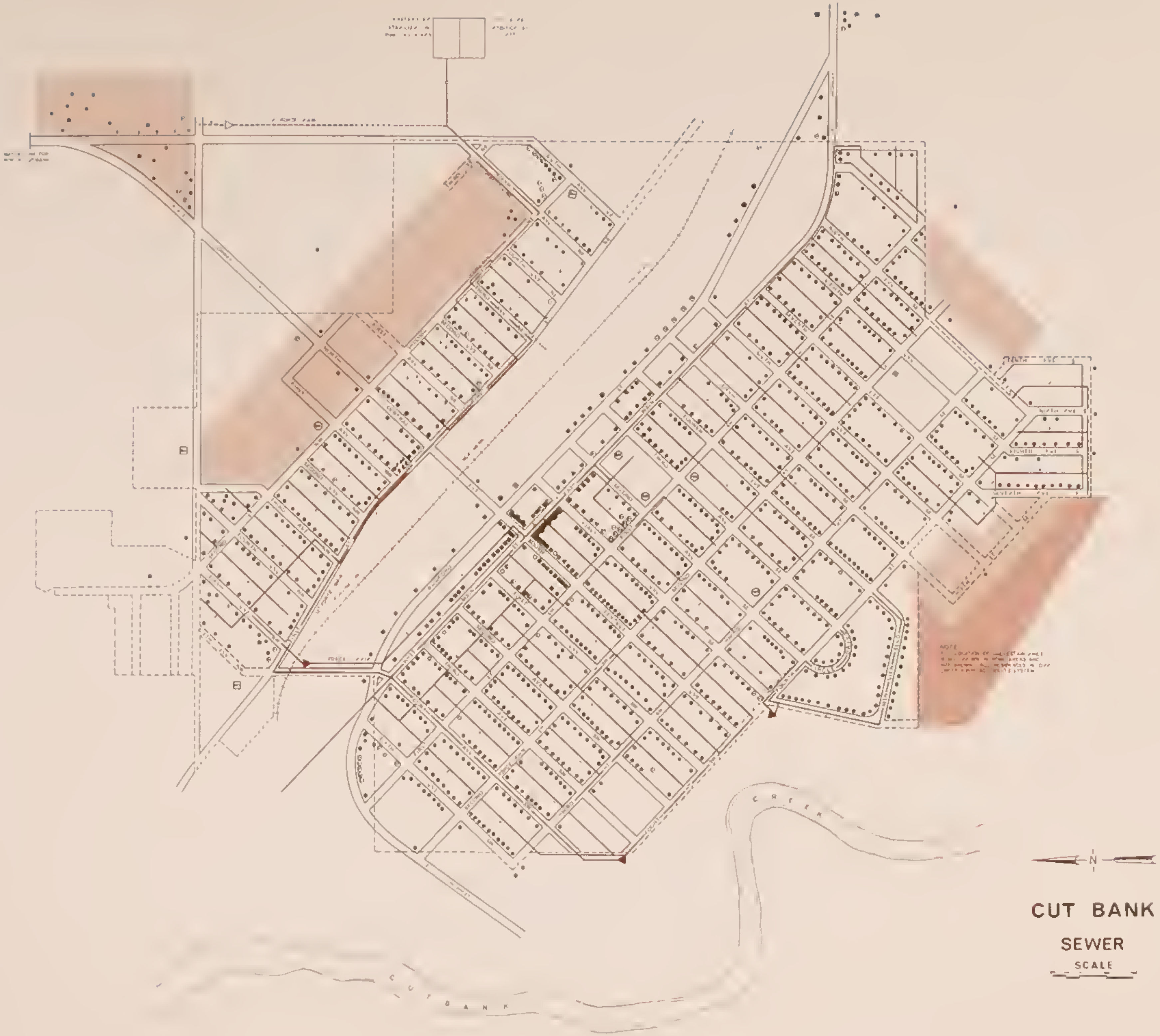
WATER

MAP 11



BLACKFOOT

MAP 12

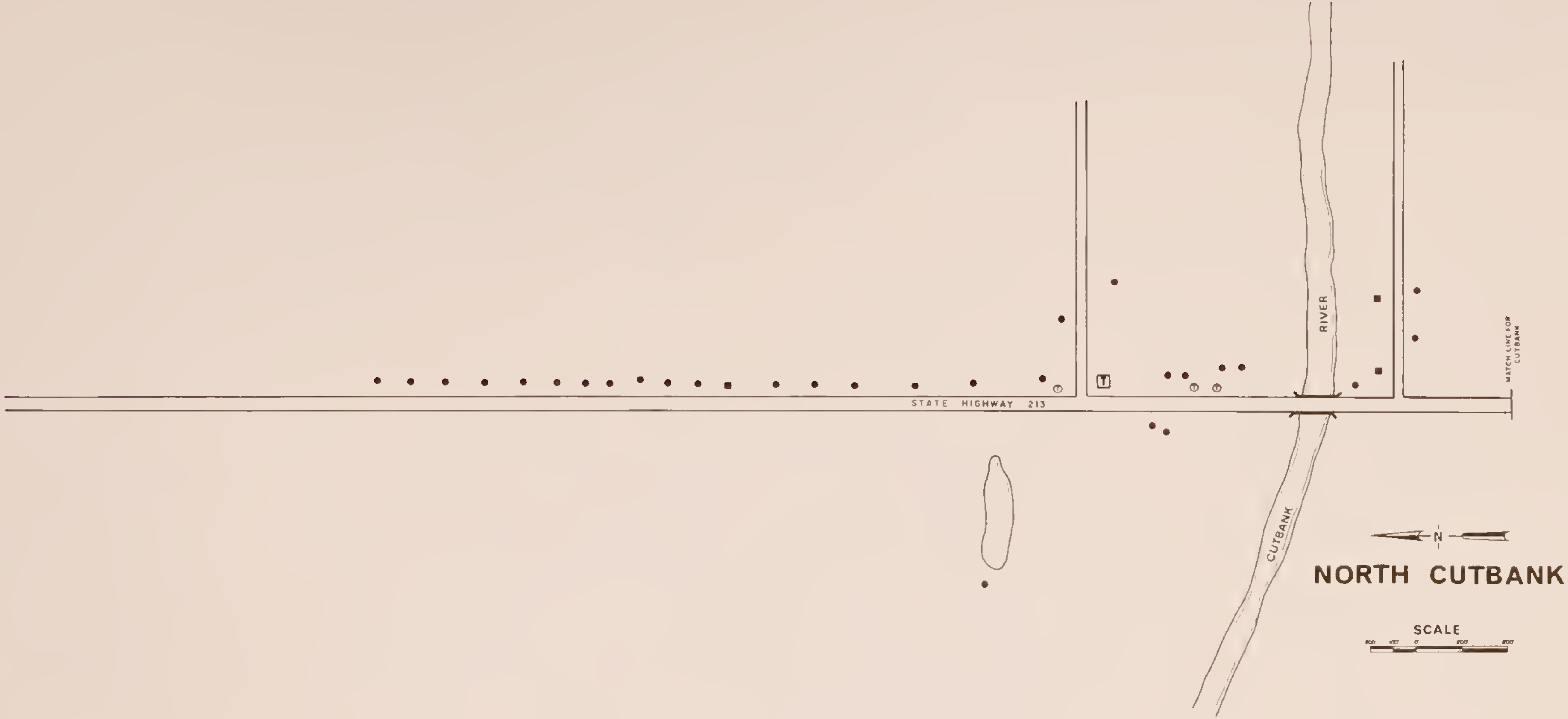


CUT BANK

SEWER

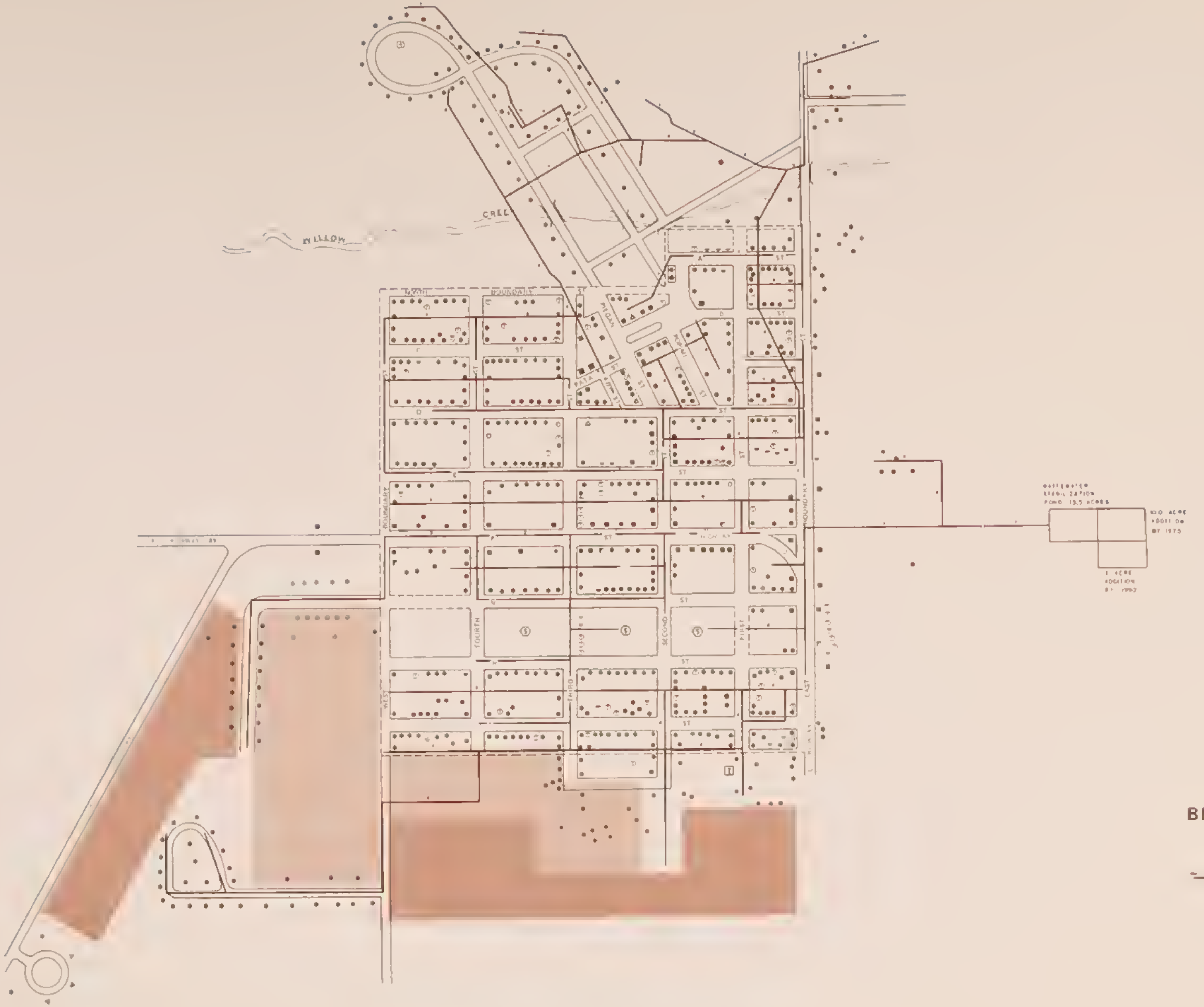
SCALE

MAP 13



NORTH CUTBANK

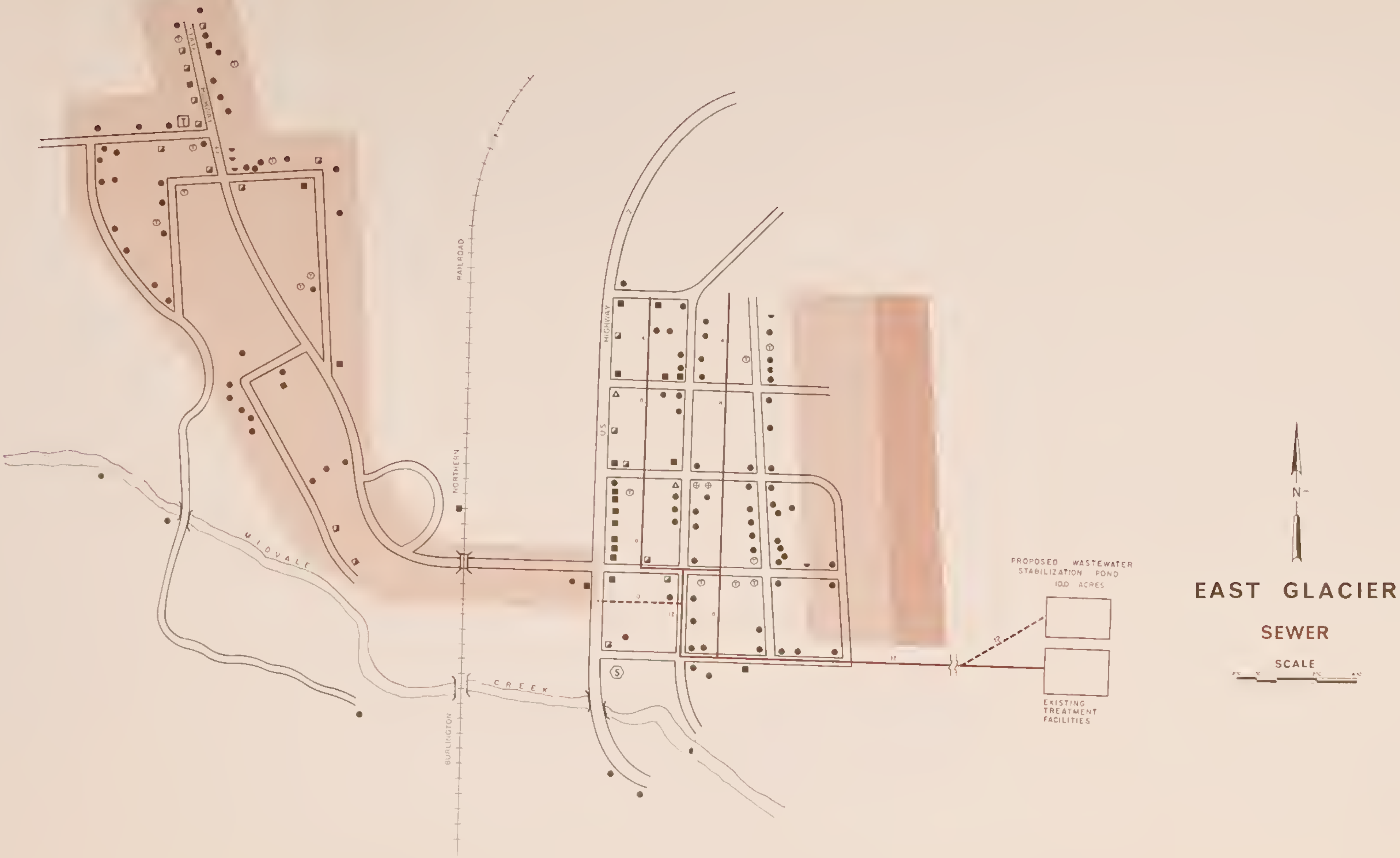
MAP 14



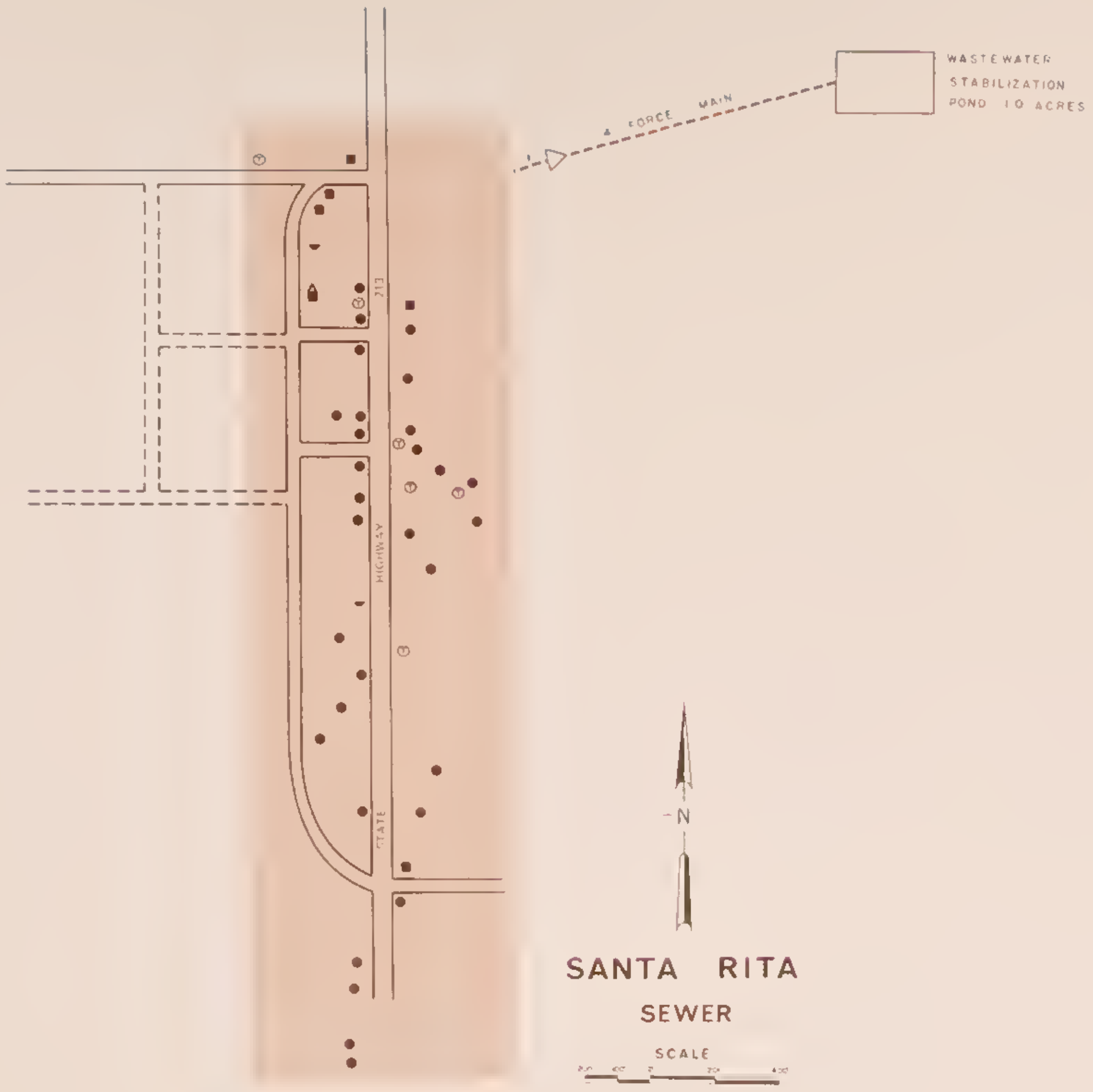
BROWNING
SEWER

SCALE

MAP 15

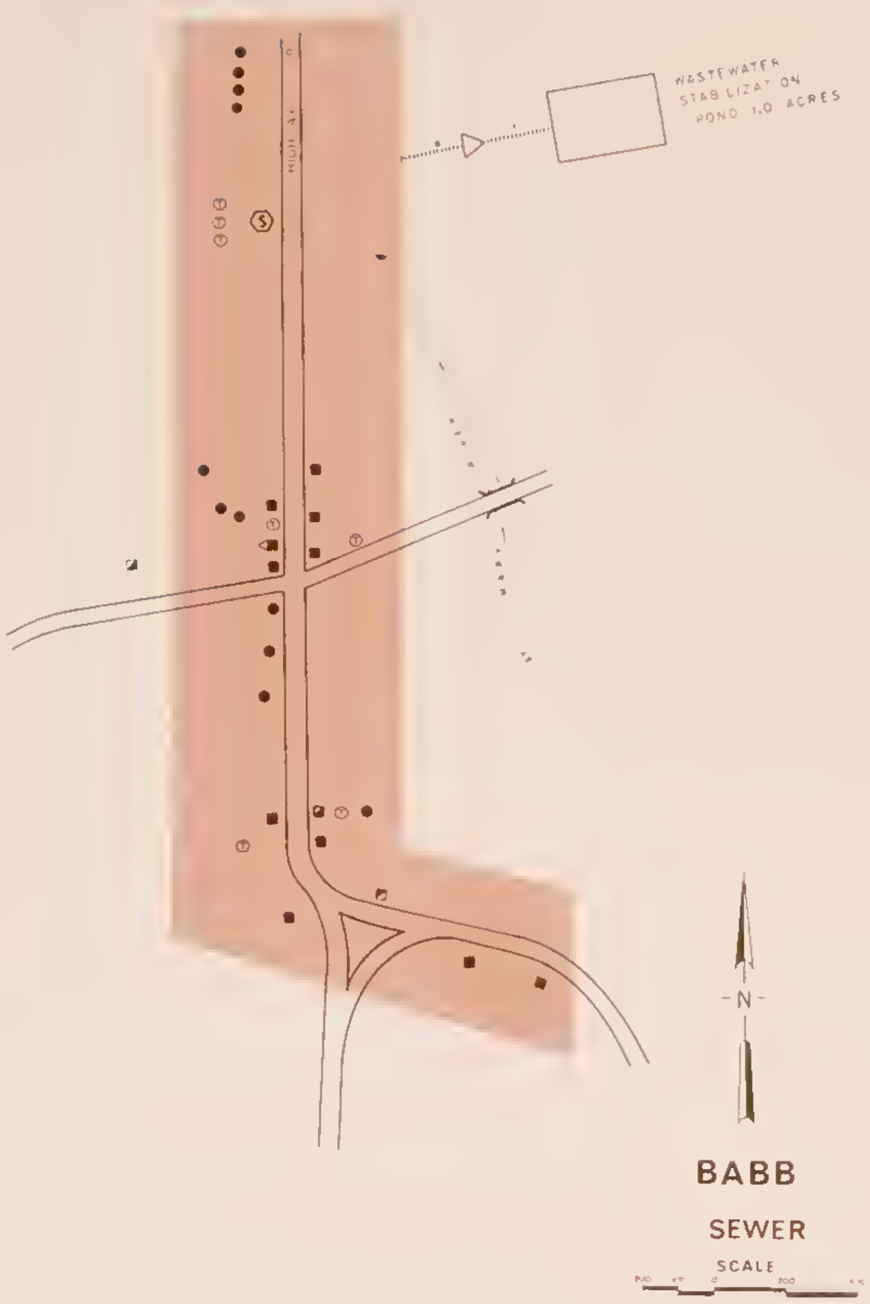

US HIGHWAY
2
BURLINGTON NORTHERN RAILROAD
MIDVALE CREEK
PROPOSED WASTEWATER STABILIZATION POND 10.0 ACRES
EXISTING TREATMENT FACILITIES
N
EAST GLACIER
SEWER
SCALE

MAP 16



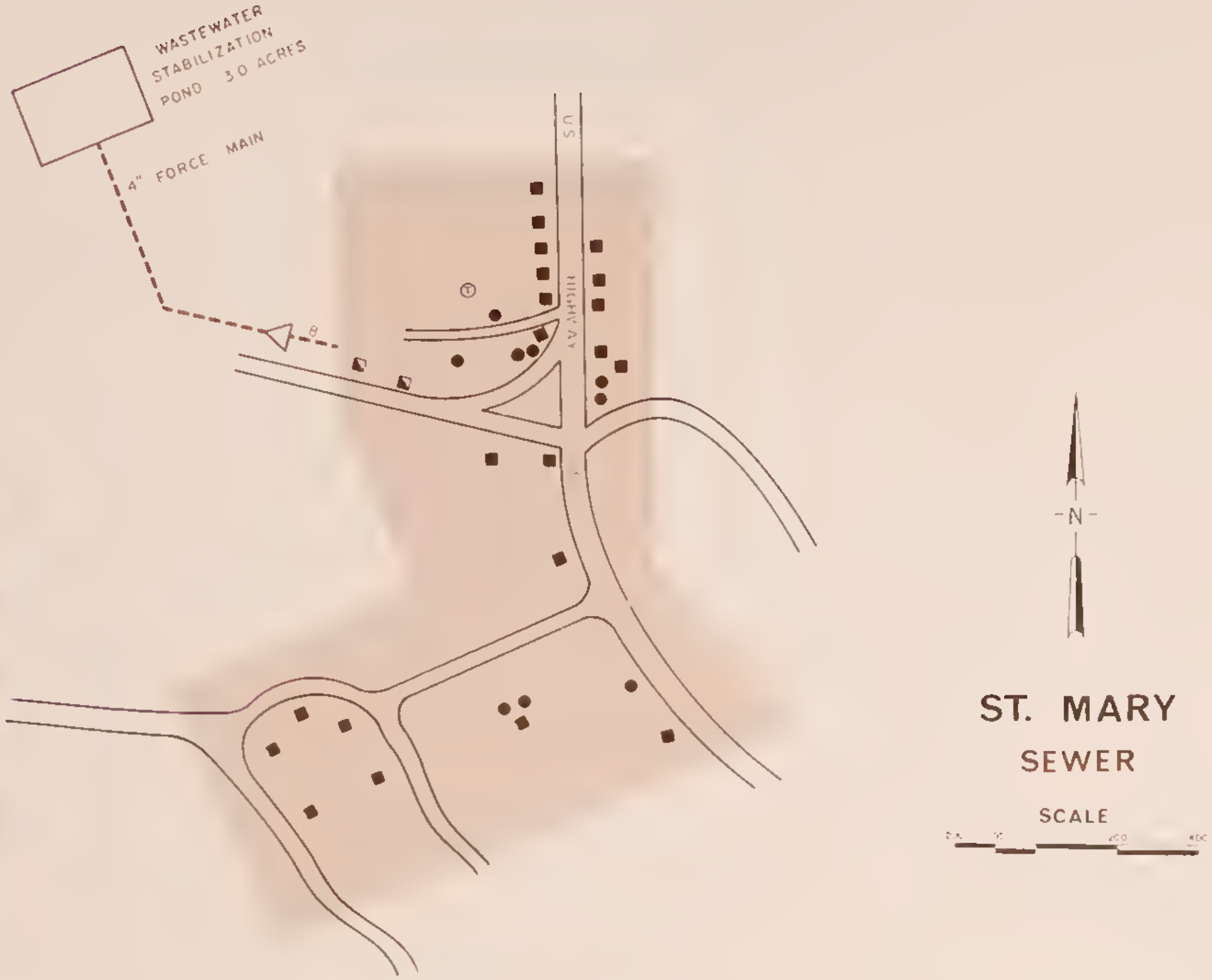
SANTA RITA

SEWER



BABB

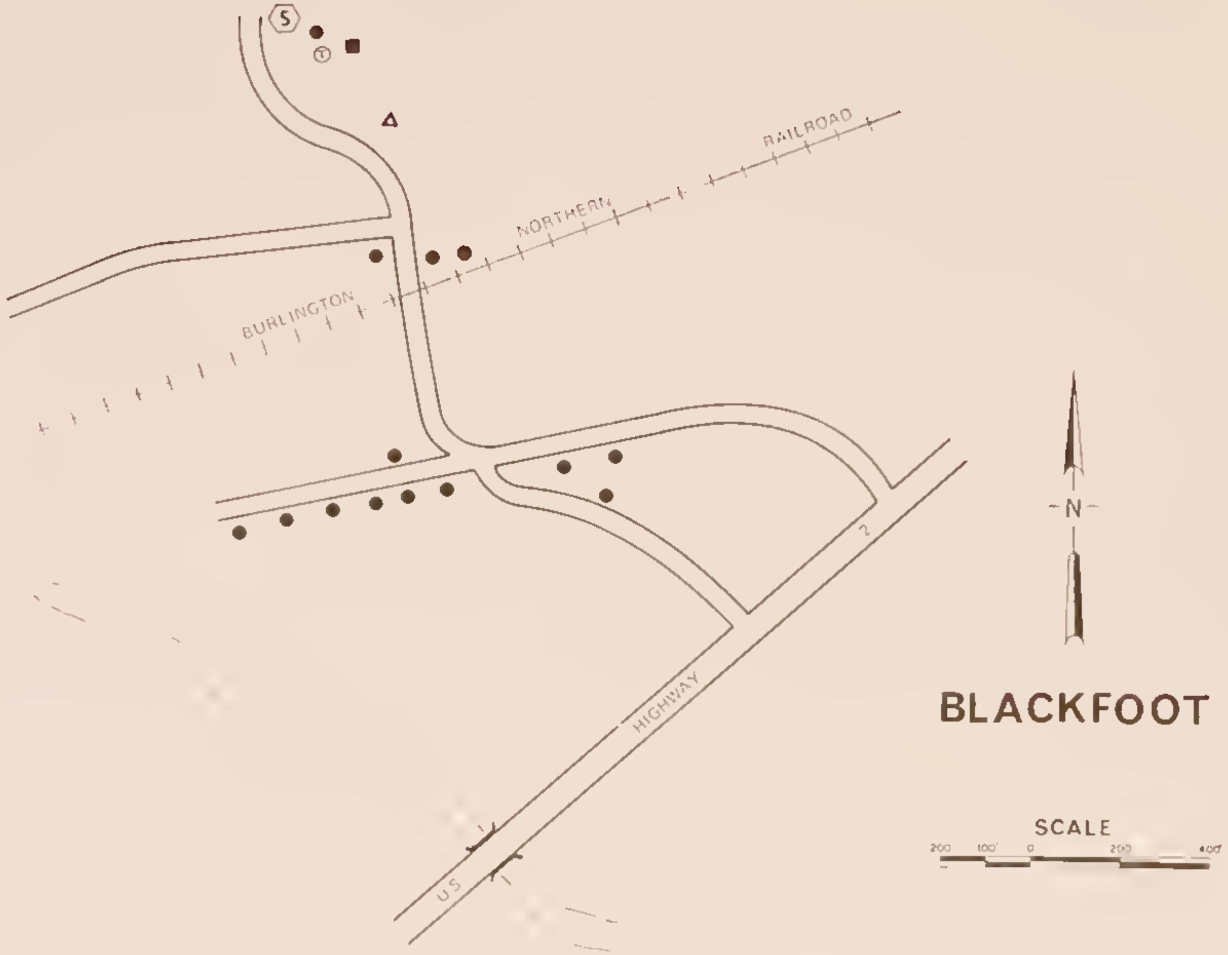
SEWER



ST. MARY

SEWER

MAP 19



BLACKFOOT

MAP 20

PREFACE

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

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PONDERA COUNTY

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Map 3 Land Ownership
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Map 6 Valier
Map 7 Brady
Map 8 Dupuyer
Map 9 Heart Butte
Map 10 Ledge

Pondera County Sewer System

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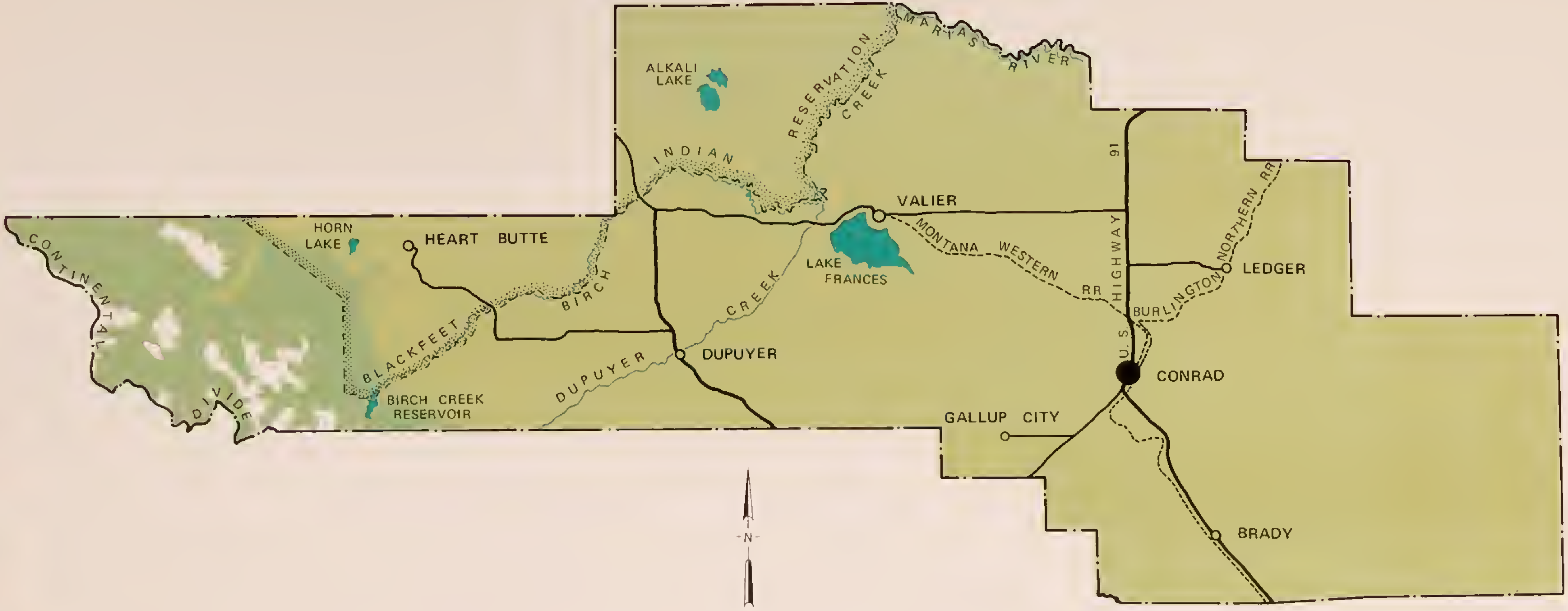
Map 12 Valier
Map 13 Brady
Map 14 Dupuyer
Map 15 Heart Butte
Map 16 Ledge

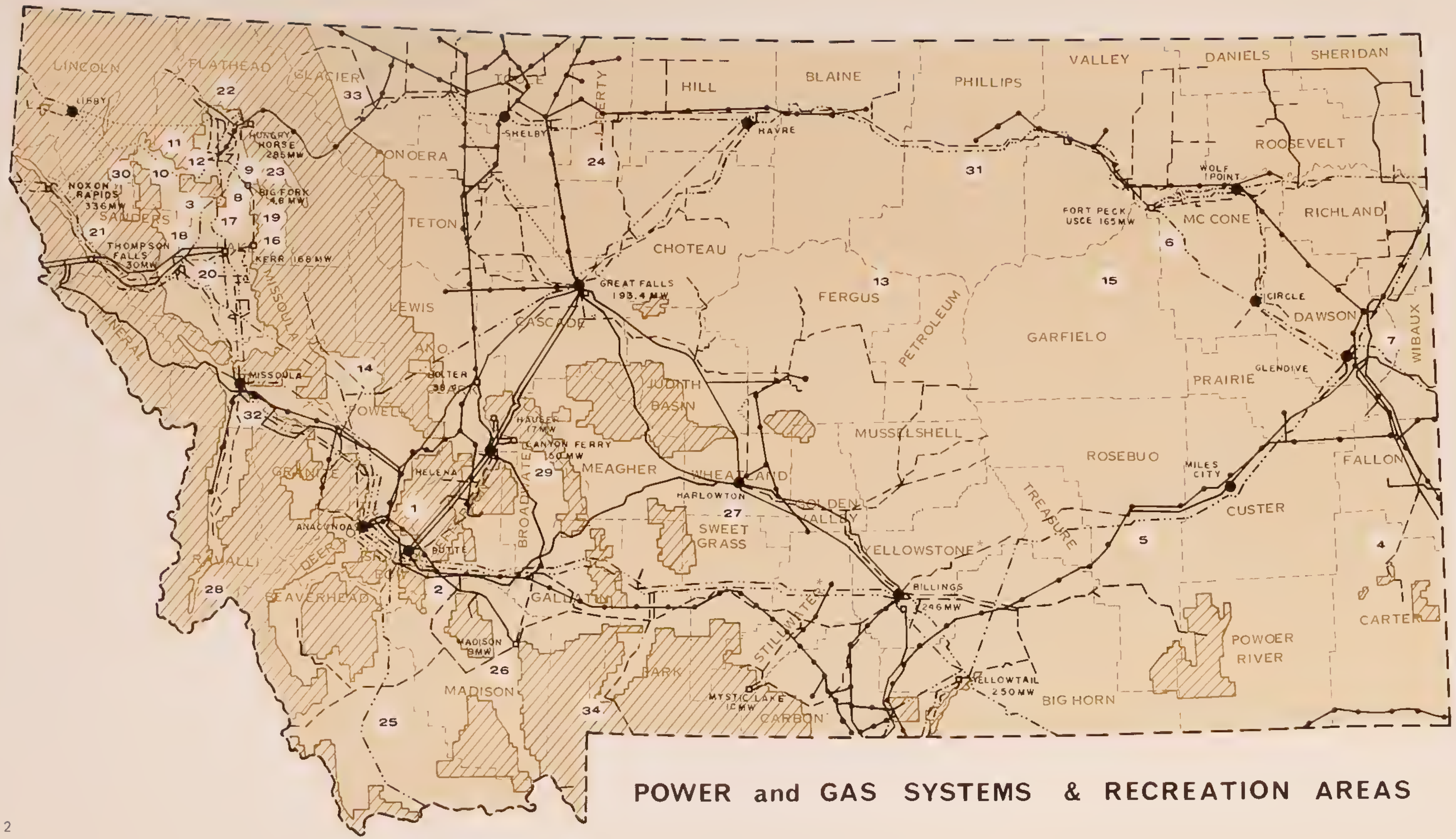


PONDERA COUNTY

TOPOGRAPHY

SCALE

MAP 1



POWER and GAS SYSTEMS & RECREATION AREAS

MAP 2

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS
STATE HIGHWAY U. S. HIGHWAY

RAILROADS

STREAMS-LAKES

COUNTY BOUNDARY

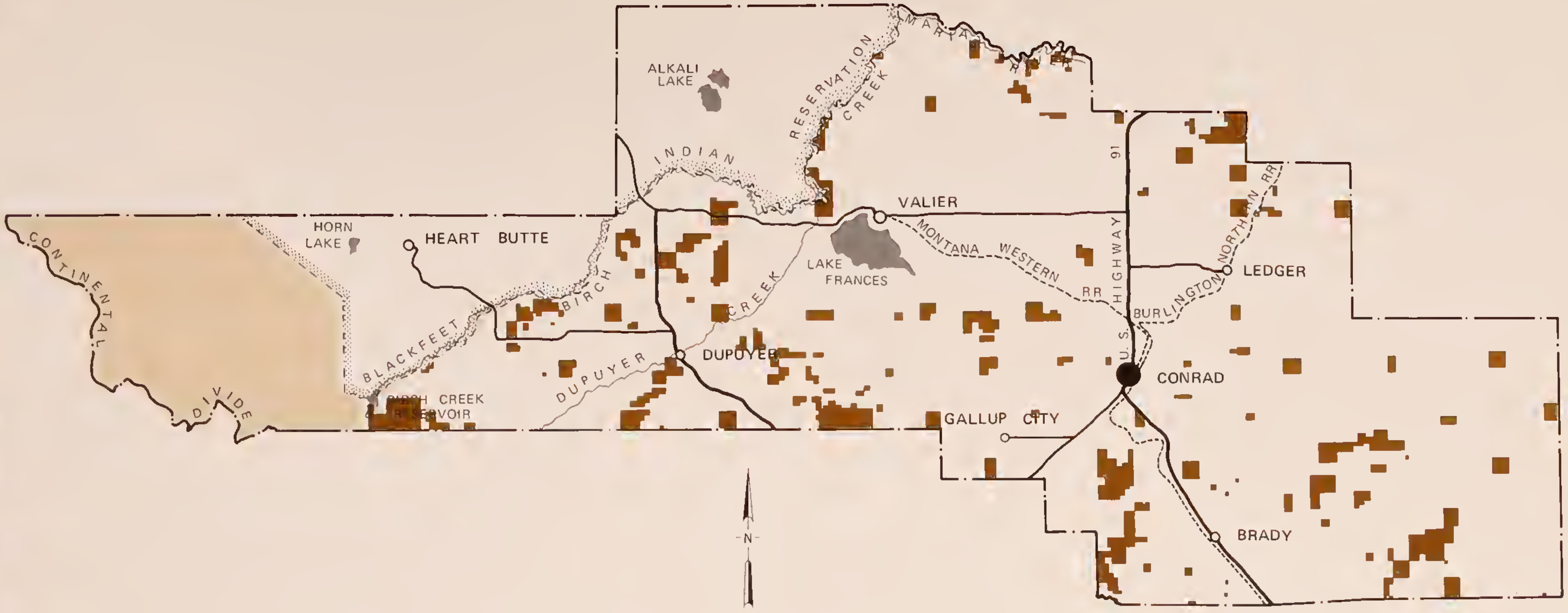
INDIAN RESERVATION

▭ 0-3,000 FT. ELEVATION

▭ 3-5,000 FT. ELEVATION

▭ 5-7,000 FT. ELEVATION

▭ OVER 7,000 FT. ELEVATION



PONDERA COUNTY

LAND OWNERSHIP

SCALE

5 0 5 10 Miles

MAP 3

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

- ☐ POWER PLANT (IN MEGAWATTS)
- ---- 1 to 50 KILOVOLTS
- —— 51 to 100 KILOVOLTS
- -·-·- 101+ KILOVOLTS
- ····· PROPOSED LINES
- -•-•- GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
2. LEWIS AND CLARK CAVERNS STATE PARK
3. LAKE MARY RONAN STATE PARK
4. MEDICINE ROCKS STATE PARK
5. ROSEBUD STATE PARK
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10. BITTERROOT LAKE STATE PARK
11. ASHLEY LAKE STATE PARK
12. LONE PINE STATE PARK
13. JAMES KIPP STATE PARK
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15. HELL CREEK STATE PARK
16. FINLEY POINT STATE PARK
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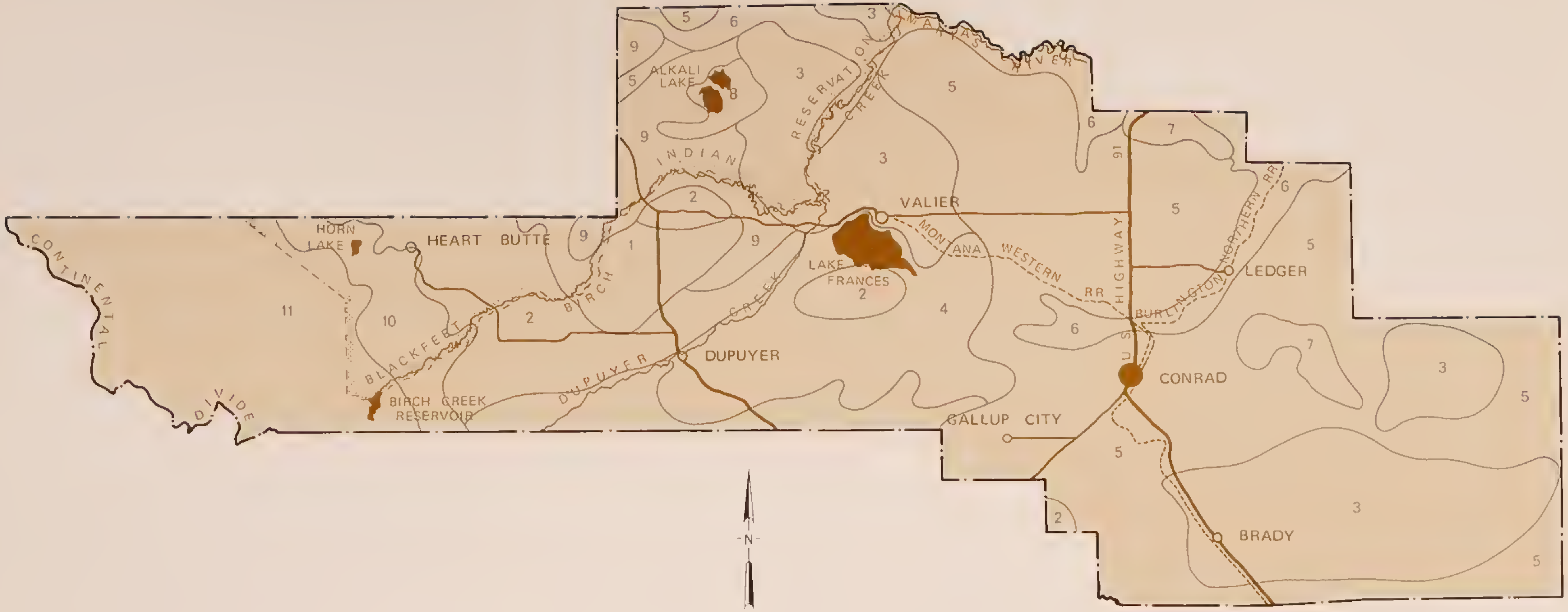
31. NELSON RESERVOIR RECREATION AREA
32. BEAVERTAIL HILL RECREATION AREA
33. GLACIER NATIONAL PARK
34. YELLOWSTONE NATIONAL PARK

▨ NATIONAL FORESTS



PONDERA COUNTY

SOILS

SCALE

5 0 5 10 Miles

Note: Numbers correspond to soils descriptions listed in the text.

Source: USDA Soil Conservation Service

MAP 4

COUNTY MAP
LAND OWNERSHIP

LEGEND

- ● CITIES-TOWNS
- ○ COUNTY SEAT
- ROADS-HIGHWAYS
  - STATE HIGHWAY
  - U. S HIGHWAY
- RAILROADS
- STREAMS-LAKES
- COUNTY BOUNDARY
- INDIAN RESERVATION
- PRIVATELY OWNED LAND
- STATE OWNED LAND
- FEDERAL OWNED LAND

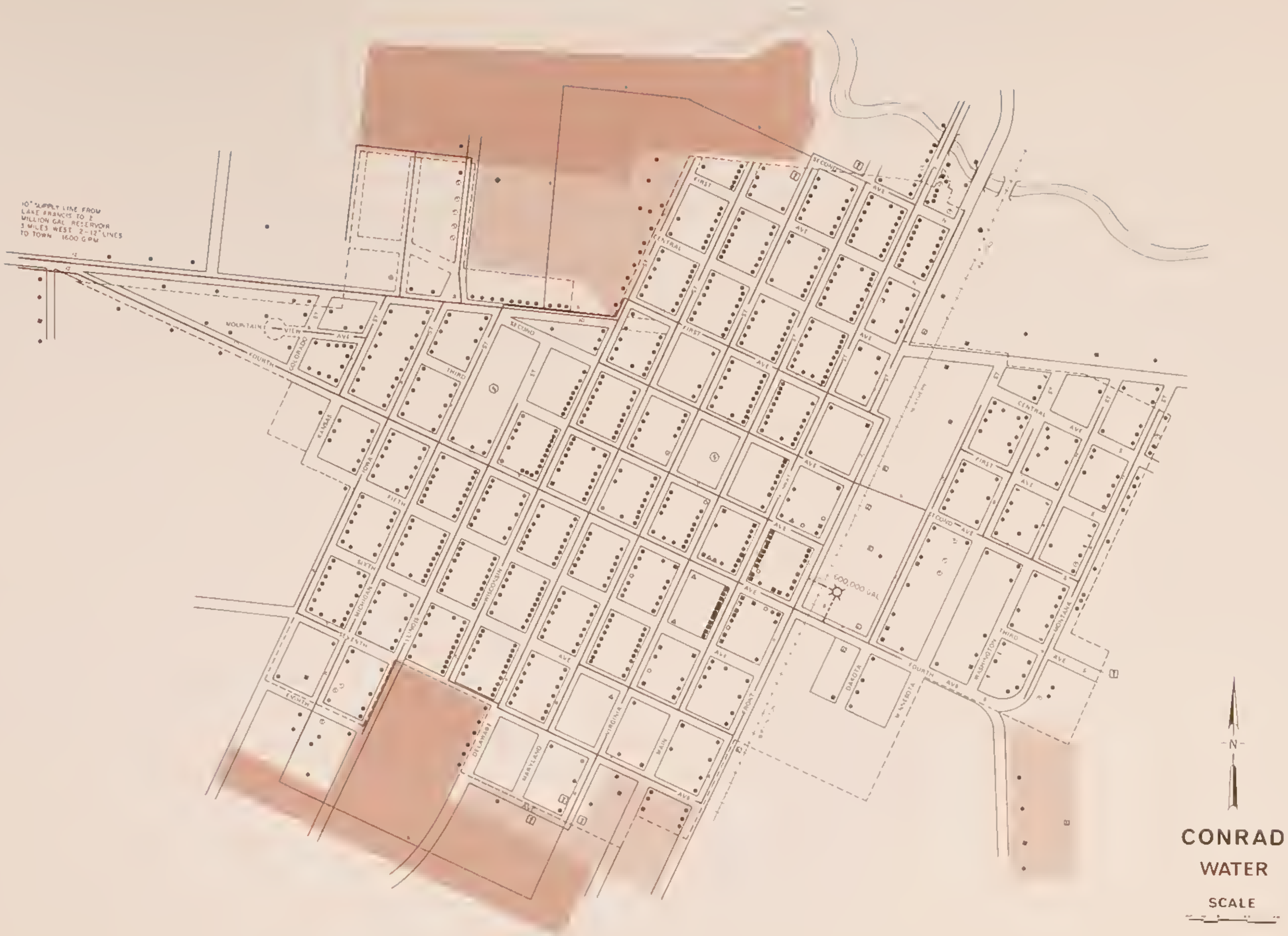
CITIES MAP LEGEND

LAND USE

●	SINGLE RESIDENCE
◒	DILAPIDATED RESIDENCE
Ⓣ	SINGLE TRAILER RESIDENCE
⊕	MULTIPLE RESIDENCE
○	APARTMENTS
T	TRAILER COURT
■	COMMERCIAL BUILDING
◪	HOTEL-MOTEL
△	PUBLIC BUILDING
S	SCHOOL
⬢	CHURCH
⊞	HOSPITAL
✹	INDUSTRIAL
E	GRAIN ELEVATOR

WATER and SEWER SYSTEMS

—6—	EXISTING LINES AND SIZES
- - - -	PROPOSED LINES 5-10 YEAR
┈┈┈┈	PROPOSED LINES 10-20 YEAR
—◀—	EXISTING LIFT STATION
--◁--	PROPOSED LIFT STATION
●	EXISTING WATER STORAGE TANK
○	PROPOSED WATER STORAGE TANK
—⊡	EXISTING WATER SOURCE
--⊡	PROPOSED WATER SOURCE
—□	EXISTING TREATMENT FACILITIES
--□	PROPOSED TREATMENT FACILITIES
▭	SERVICE AREA 1970-1980
▬	SERVICE AREA BY 1990

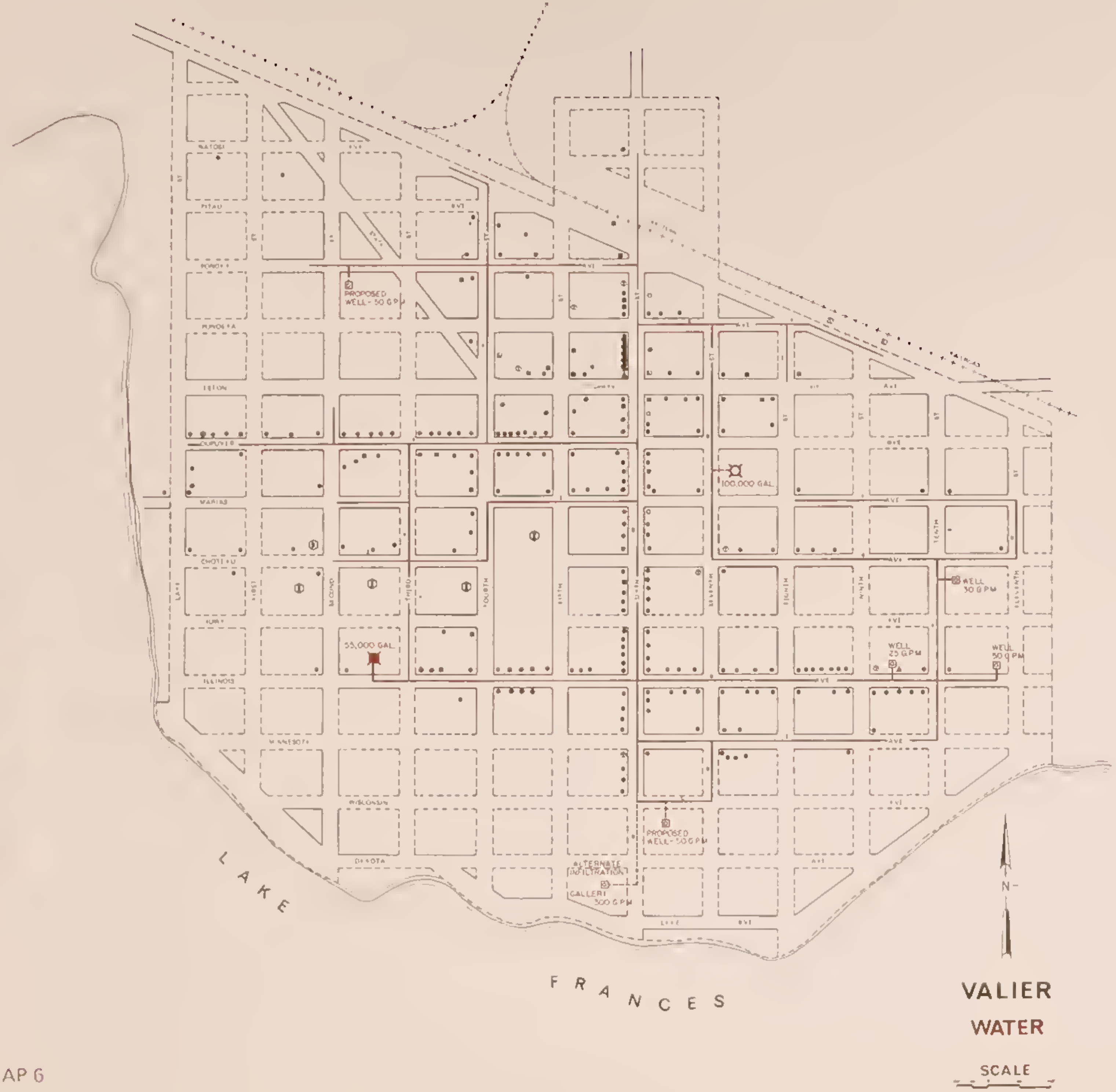


CONRAD

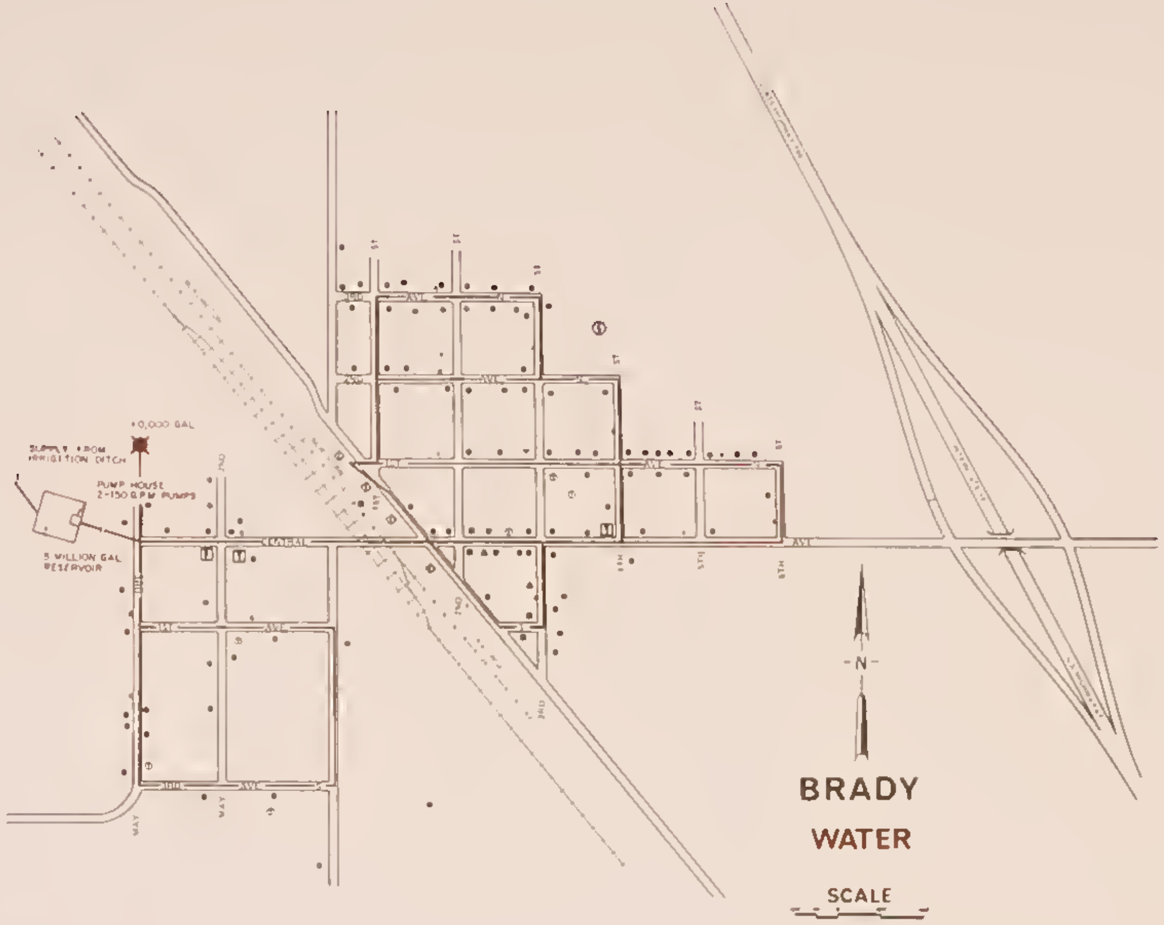
WATER

SCALE

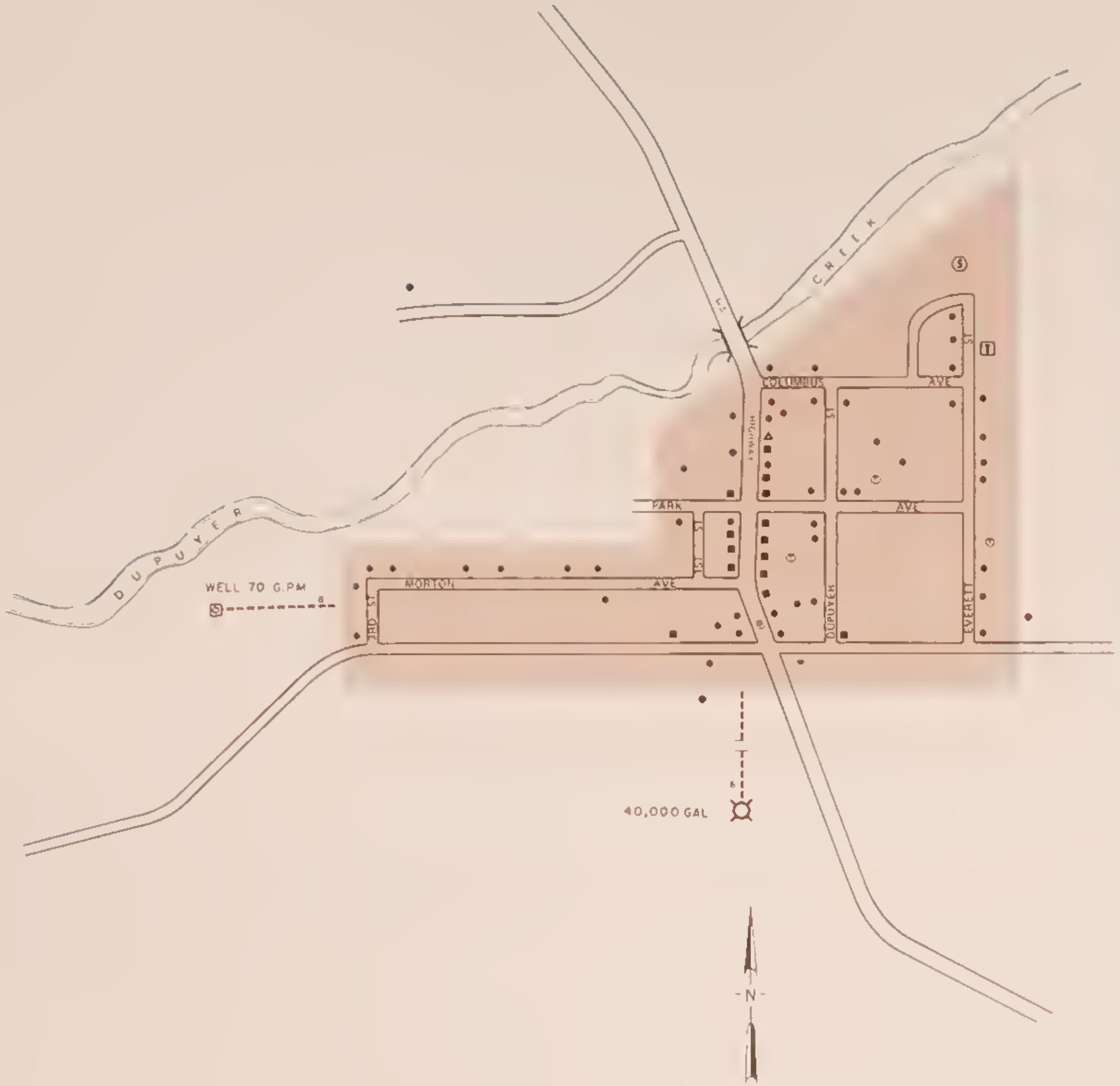
MAP 5


PROPOSED WELL - 50 GPM
100,000 GAL.
WELL 30 GPM
55,000 GAL.
WELL 25 GPM
WELL 50 GPM
PROPOSED WELL - 500 GPM
ALTERNATE INFILTRATION GALLERY 300 GPM
LAKE
FRANCES
N
VALIER
WATER
SCALE

MAP 6


40,000 GAL
SUPPLY FROM IRRIGATION DITCH
PUMP HOUSE 2-150 G.P.M. PUMPS
5 MILLION GAL RESERVOIR
CENTRAL
AVE
N
BRADY
WATER
SCALE

MAP 7

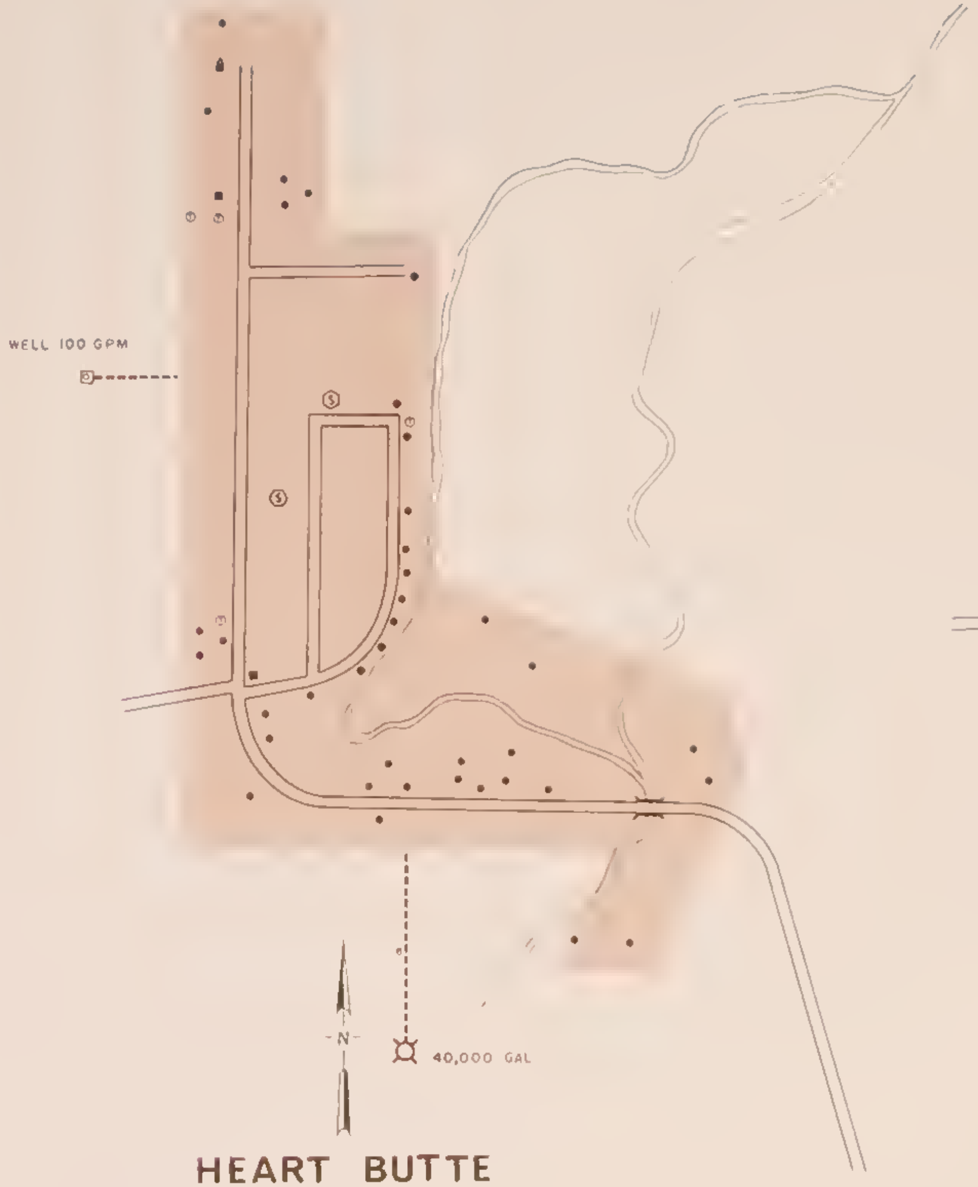


DUPUYER

WATER

SCALE

MAP 8

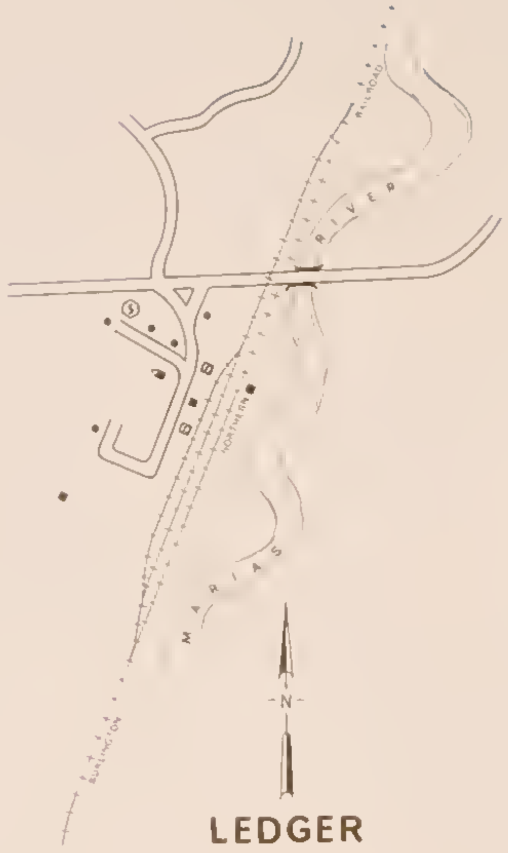


HEART BUTTE

WATER

SCALE

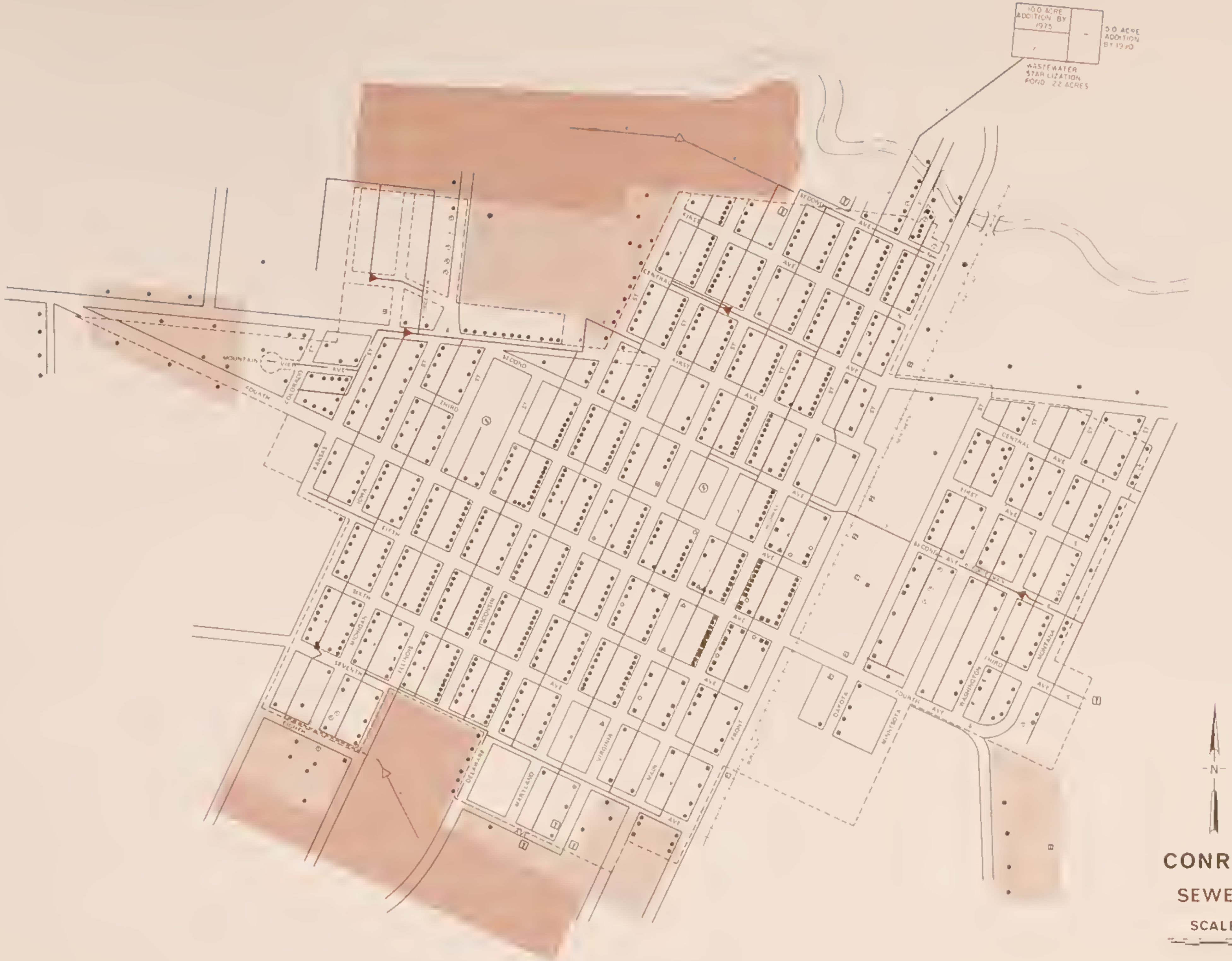
MAP 9



LEDGER

SCALE

MAP 10

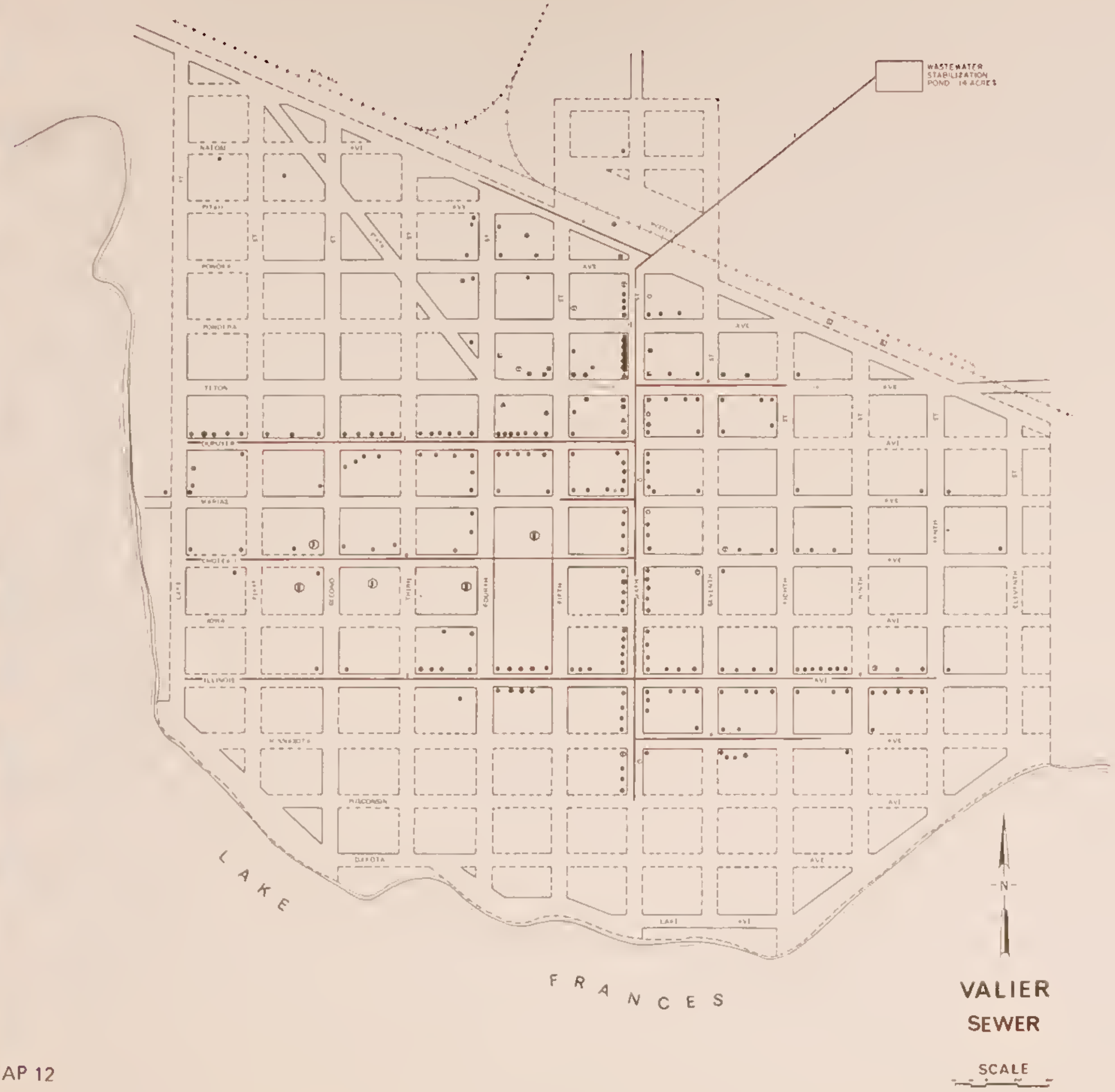


CONRAD

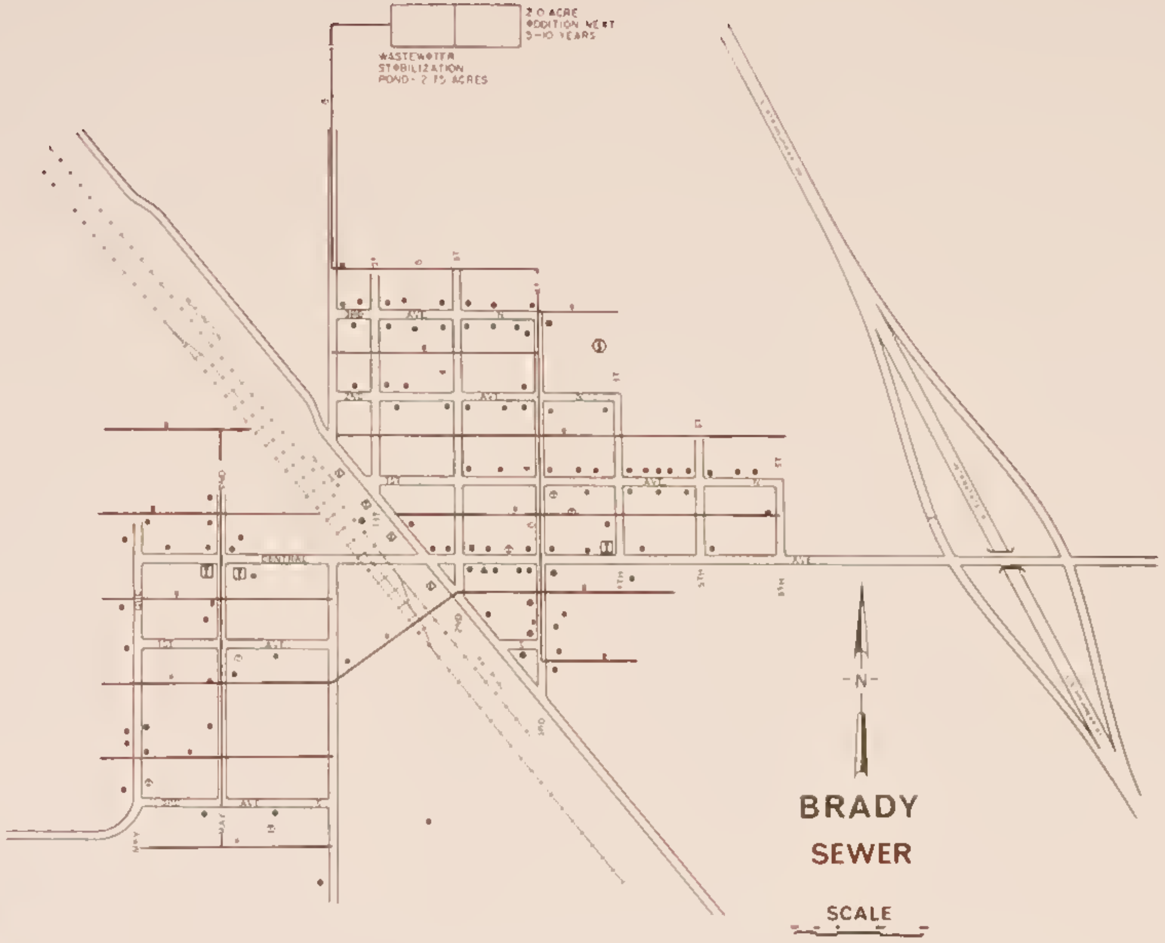
SEWER

SCALE

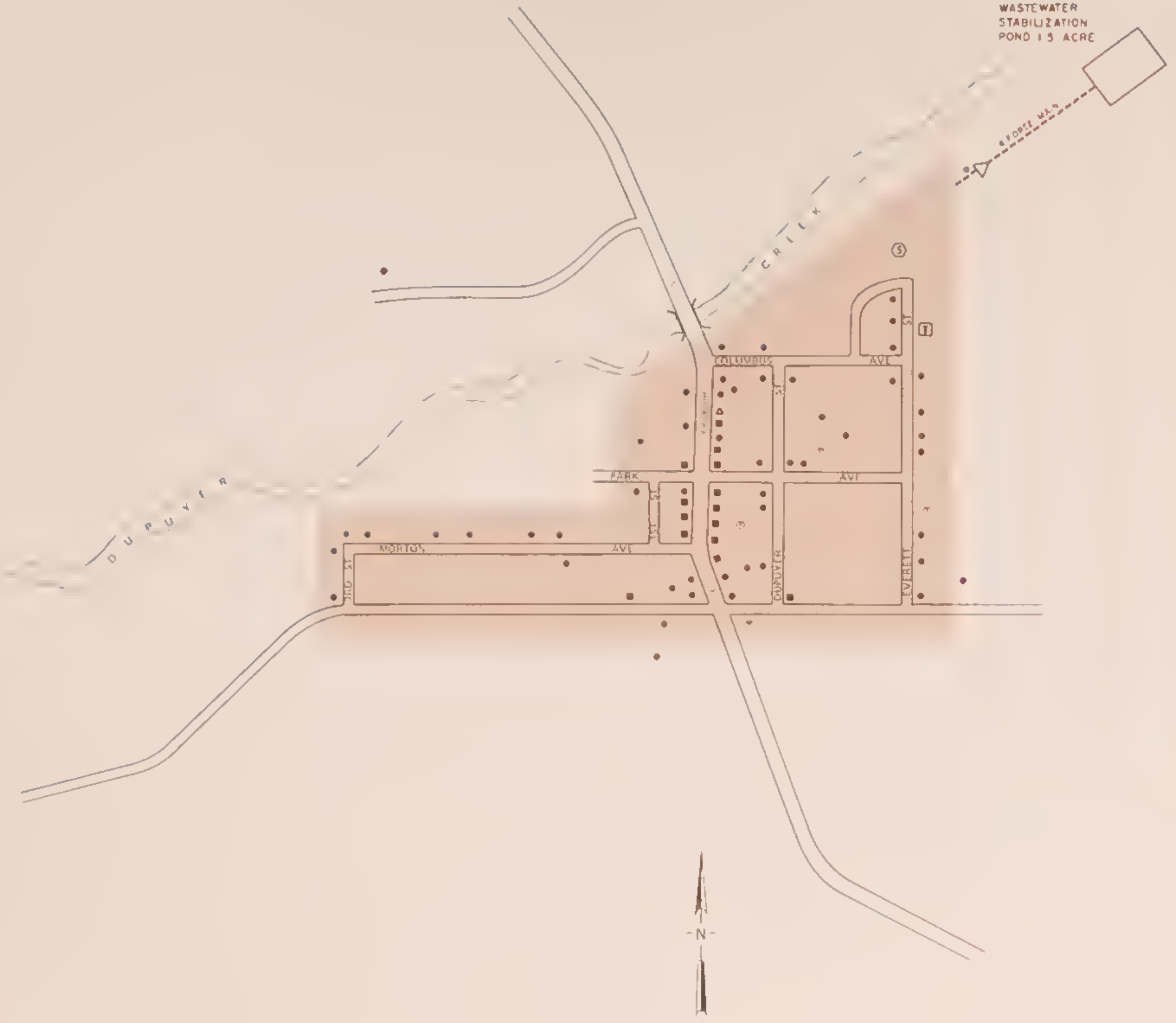
MAP 11


WASTEWATER
STABILIZATION
POND 14 ACRES
PONDERA
TETON
DUPUYER
MARIAS
MONTANA
IOWA
ILLINOIS
MINNESOTA
WISCONSIN
DAKOTA
LAKE AVE
AVE
ST
LAKE
FIRST
SECOND
THIRD
FOURTH
FIFTH
SIXTH
SEVENTH
EIGHTH
NINTH
TENTH
ELEVENTH
LAKE
FRANCES
N
VALIER
SEWER
SCALE

MAP 12


2.0 ACRE
ADDITION NEXT
5-10 YEARS
WASTEWATER
STABILIZATION
POND - 2.75 ACRES
CENTRAL
AVE
ST
2ND
5TH
N
BRADY
SEWER
SCALE

MAP 13

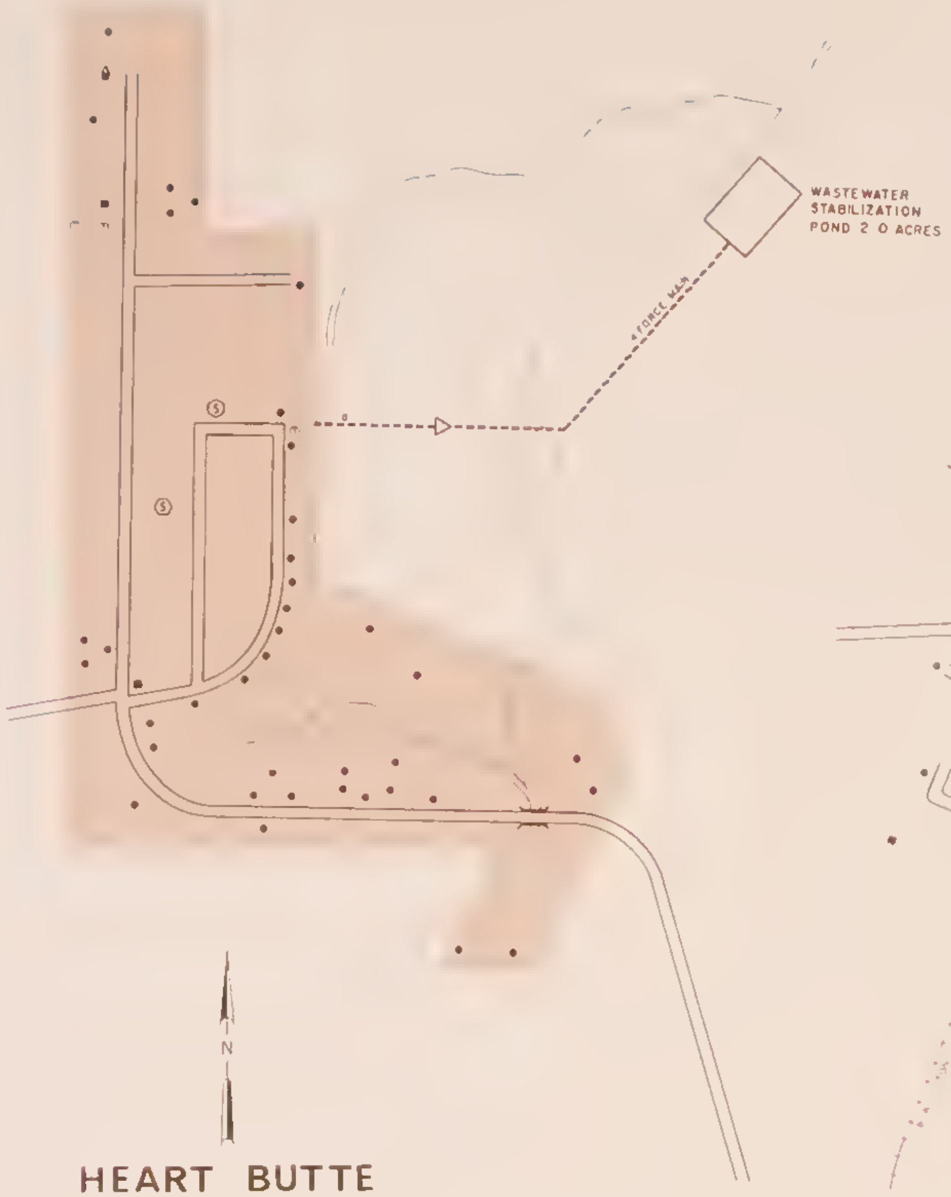


DUPUYER

SEWER

SCALE

MAP 14

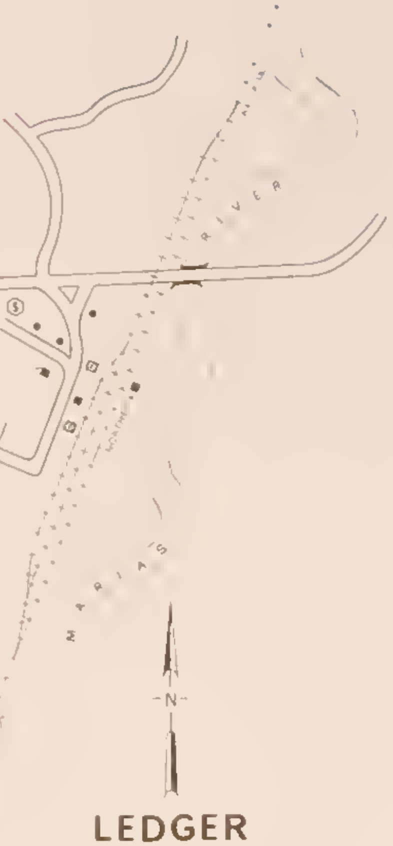


HEART BUTTE

SEWER

SCALE

MAP 15



LEDGER

SCALE

MAP 16

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TETON COUNTY

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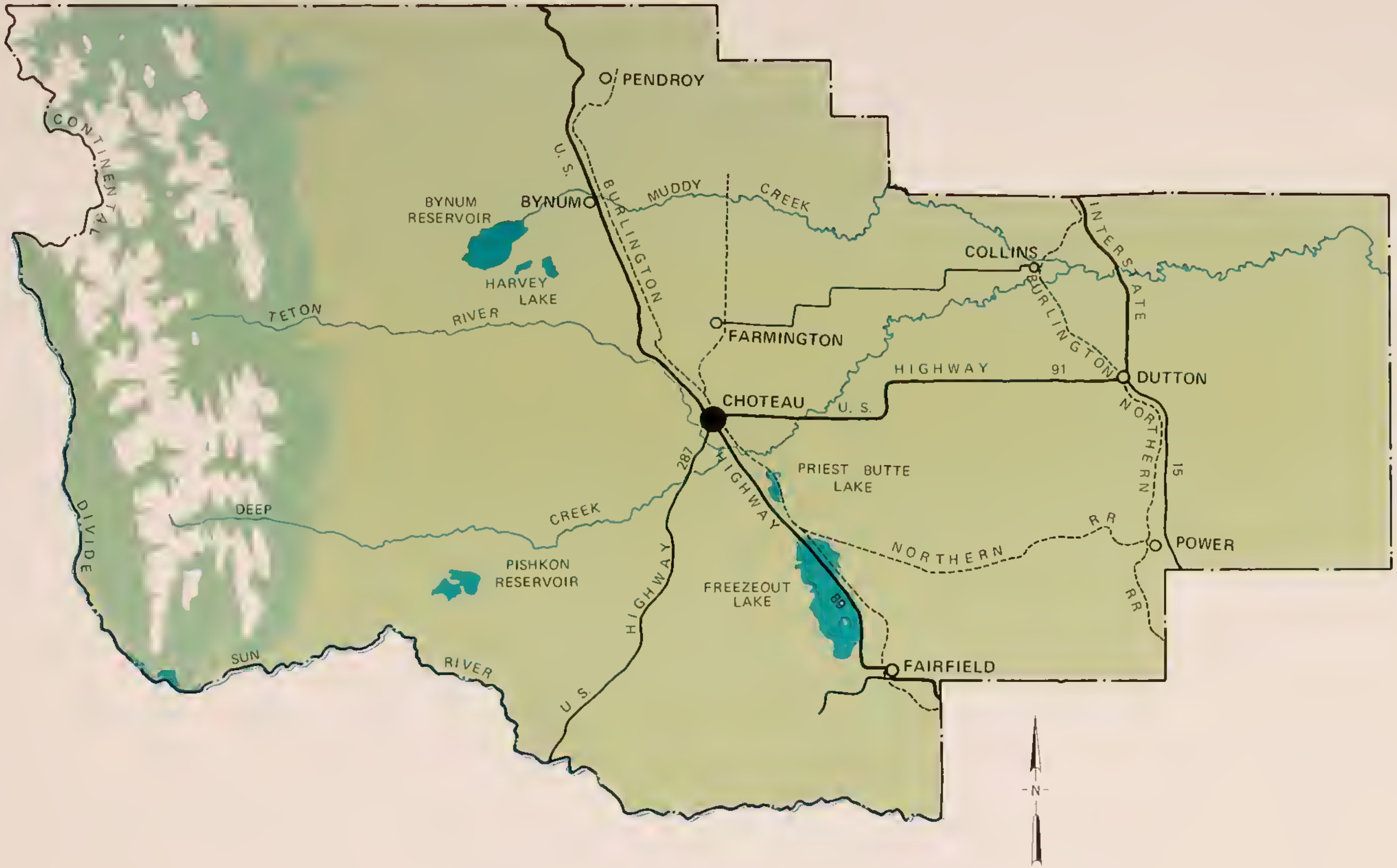
Map 6 Fairfield
Map 7 Dutton
Map 8 Power
Map 9 Pendroy
Map 10 Bynum
Map 11 Farmington
Map 12 Collins

Teton County Sewer System

Map 13 Choteau
Map 14 Fairfield
Map 15 Dutton
Map 16 Power
Map 17 Pendroy

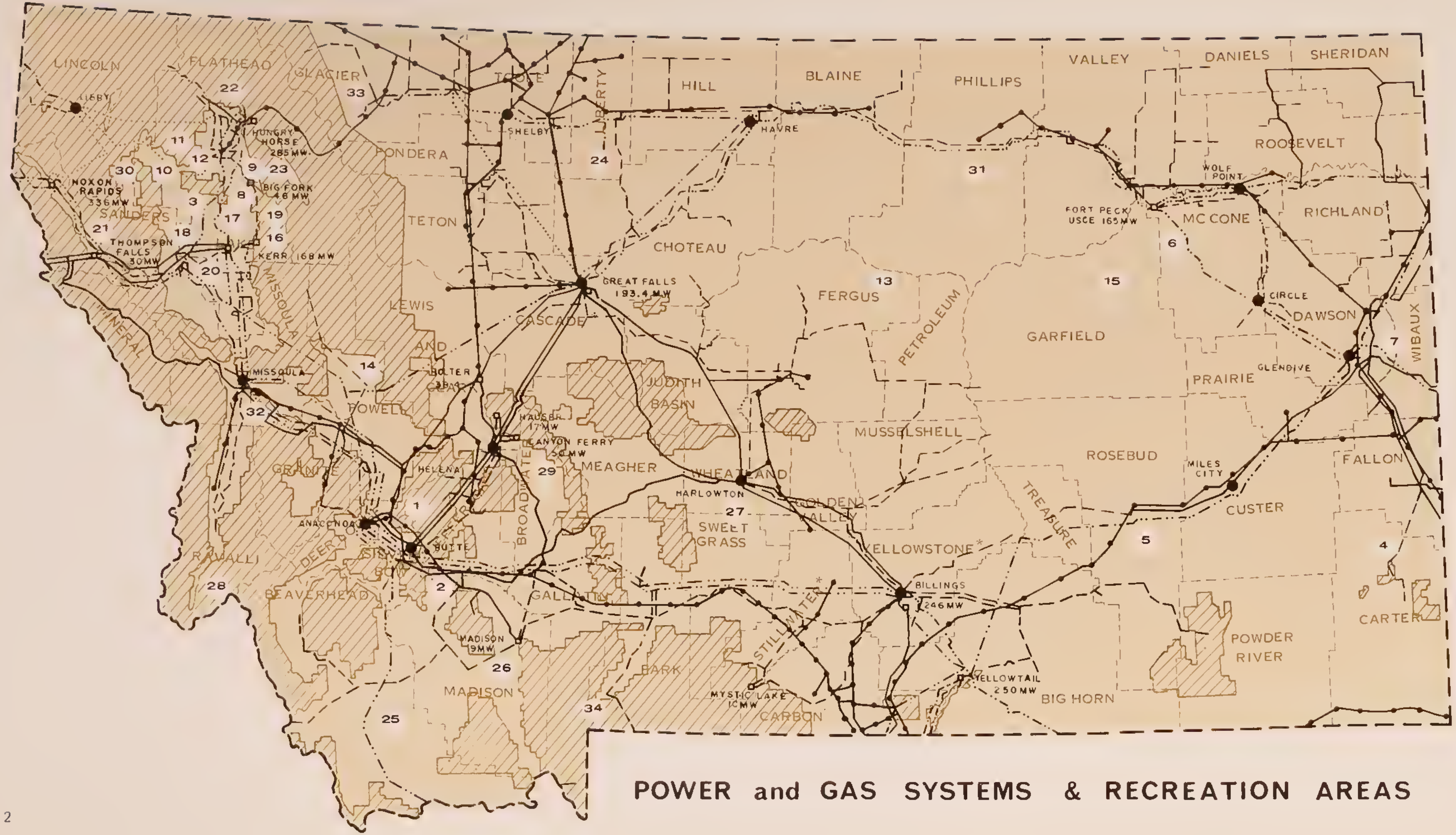


TETON COUNTY

TOPOGRAPHY

SCALE

MAP 1



POWER and GAS SYSTEMS & RECREATION AREAS

MAP 2

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS
STATE HIGHWAY U. S. HIGHWAY

RAILROADS

STREAMS-LAKES

COUNTY BOUNDARY

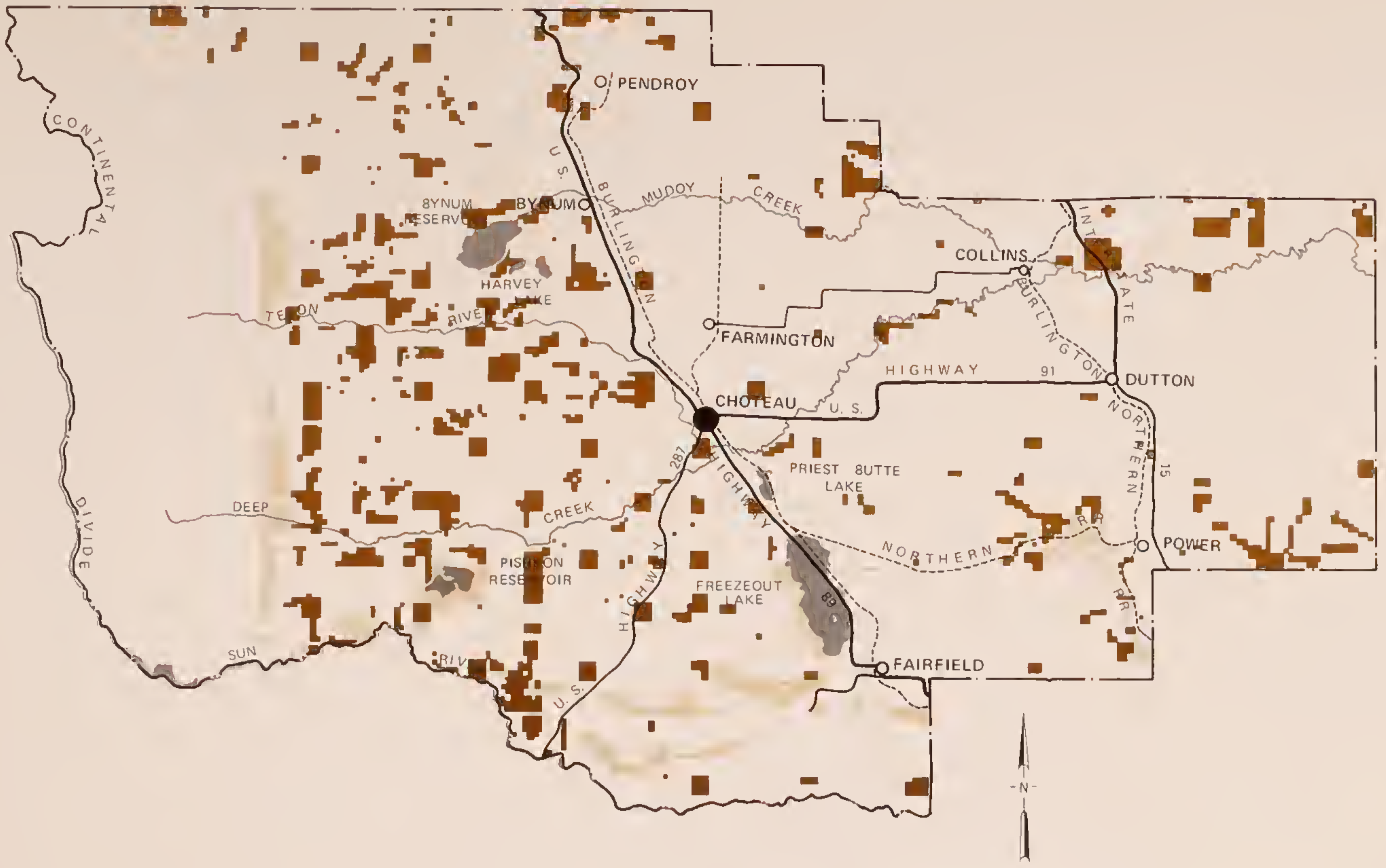
INDIAN RESERVATION

0-3,000 FT. ELEVATION

3-5,000 FT. ELEVATION

5-7,000 FT. ELEVATION

OVER 7,000 FT. ELEVATION



TETON COUNTY

LAND OWNERSHIP

SCALE

MAP 3

LEGEND

MAJOR STATE-WIDE COVERAGE

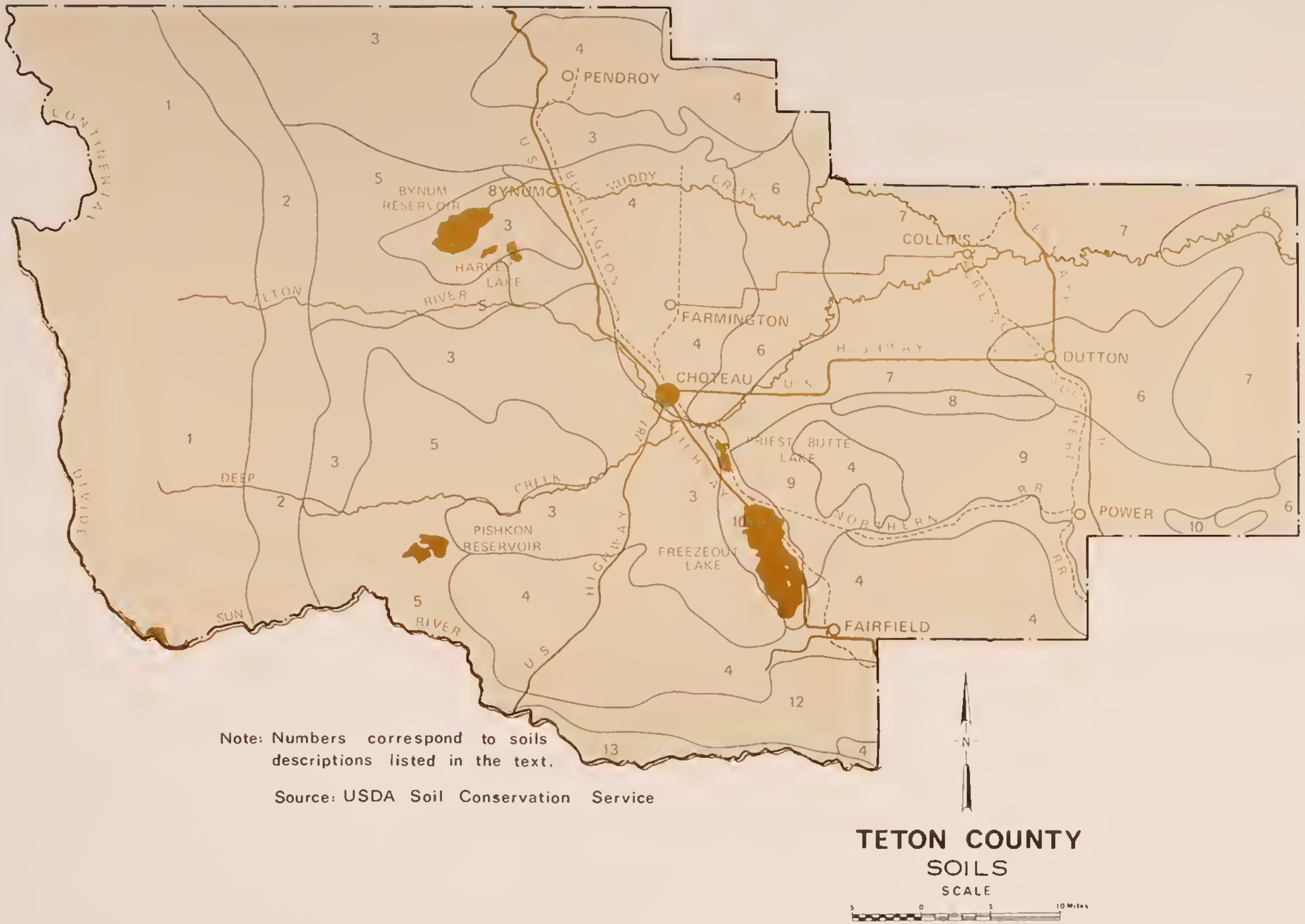
POWER AND GAS SYSTEMS

☐ POWER PLANT (IN MEGAWATTS)
---- 1 to 50 KILOVOLTS
—— 51 to 100 KILOVOLTS
-·-·- 101+ KILOVOLTS
····· PROPOSED LINES
-•-•- GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
2. LEWIS AND CLARK CAVERNS STATE PARK
3. LAKE MARY RONAN STATE PARK
4. MEDICINE ROCKS STATE PARK
5. ROSEBUD STATE PARK
6. ROCK CREEK STATE PARK
7. MAKOSHIKA STATE PARK
8. WEST SHORE STATE PARK
9. WOODS BAY STATE PARK
10. BITTERROOT LAKE STATE PARK
11. ASHLEY LAKE STATE PARK
12. LONE PINE STATE PARK
13. JAMES KIPP STATE PARK
14. HOOPER MEMORIAL STATE PARK
15. HELL CREEK STATE PARK
16. FINLEY POINT STATE PARK
17. ELMO STATE PARK
18. FLATHEAD LAKE STATE PARK
19. YELLOW BAY STATE PARK
20. WALSTAD MEMORIAL PARK
21. THOMPSON FALLS STATE PARK
22. WHITEFISH LAKE STATE PARK
23. WAYFARERS RECREATION AREA
24. TIBER RESERVOIR RECREATION AREA
25. CLARK CANYON RESERVOIR RECREATION AREA
26. ENNIS RECREATION AREA
27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
28. PAINTED ROCKS RESERVOIR RECREATION AREA
29. CANYON FERRY RECREATION AREA
30. LOGAN PARK RECREATION AREA
31. NELSON RESERVOIR RECREATION AREA
32. BEAVERTAIL HILL RECREATION AREA
33. GLACIER NATIONAL PARK
34. YELLOWSTONE NATIONAL PARK

▨ NATIONAL FORESTS



Note: Numbers correspond to soils descriptions listed in the text.

Source: USDA Soil Conservation Service

TETON COUNTY
SOILS
SCALE

MAP 4

COUNTY MAP
LAND OWNERSHIP

LEGEND

- ● CITIES-TOWNS
- ○ COUNTY SEAT
- ROADS-HIGHWAYS — STATE HIGHWAY, U. S. HIGHWAY
- RAILROADS
- STREAMS-LAKES
- COUNTY BOUNDARY
- INDIAN RESERVATION
- PRIVATELY OWNED LAND
- STATE OWNED LAND
- FEDERAL OWNED LAND

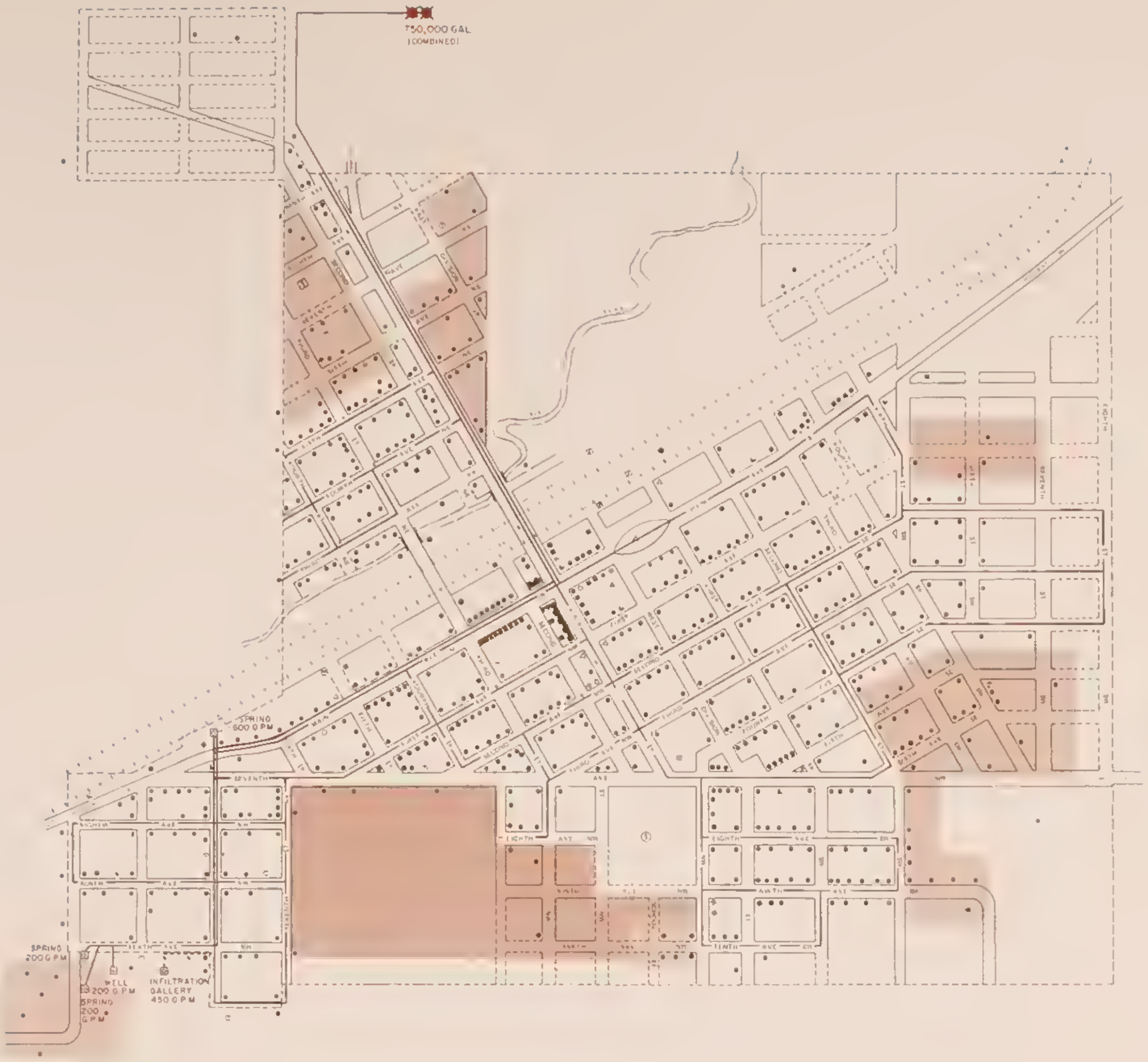
CITIES MAP LEGEND

LAND USE

●	SINGLE RESIDENCE
◒	DILAPIDATED RESIDENCE
Ⓣ	SINGLE TRAILER RESIDENCE
⊕	MULTIPLE RESIDENCE
○	APARTMENTS
🅃	TRAILER COURT
■	COMMERCIAL BUILDING
◪	HOTEL-MOTEL
△	PUBLIC BUILDING
⬡S	SCHOOL
⬢	CHURCH
⊞	HOSPITAL
✹	INDUSTRIAL
🅴	GRAIN ELEVATOR

WATER and SEWER SYSTEMS

—6—	EXISTING LINES AND SIZES
- - - - - - -	PROPOSED LINES 5-10 YEAR
··········	PROPOSED LINES 10-20 YEAR
—◀—	EXISTING LIFT STATION
- - -◁- - -	PROPOSED LIFT STATION
●	EXISTING WATER STORAGE TANK
¤	PROPOSED WATER STORAGE TANK
—⧇	EXISTING WATER SOURCE
- - -⧇	PROPOSED WATER SOURCE
—□	EXISTING TREATMENT FACILITIES
- - -□	PROPOSED TREATMENT FACILITIES
🟧	SERVICE AREA 1970-1980
🟥	SERVICE AREA BY 1990

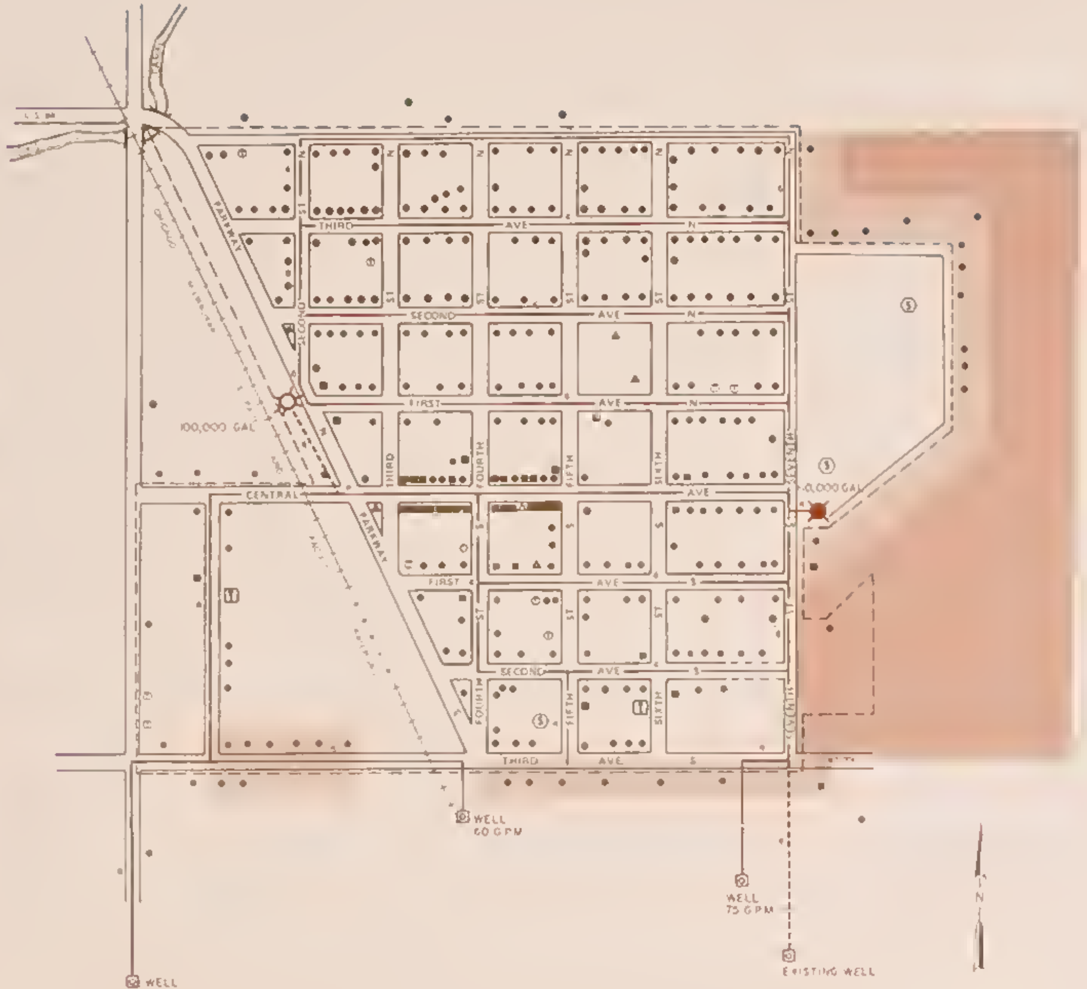


CHOTEAU

WATER

SCALE

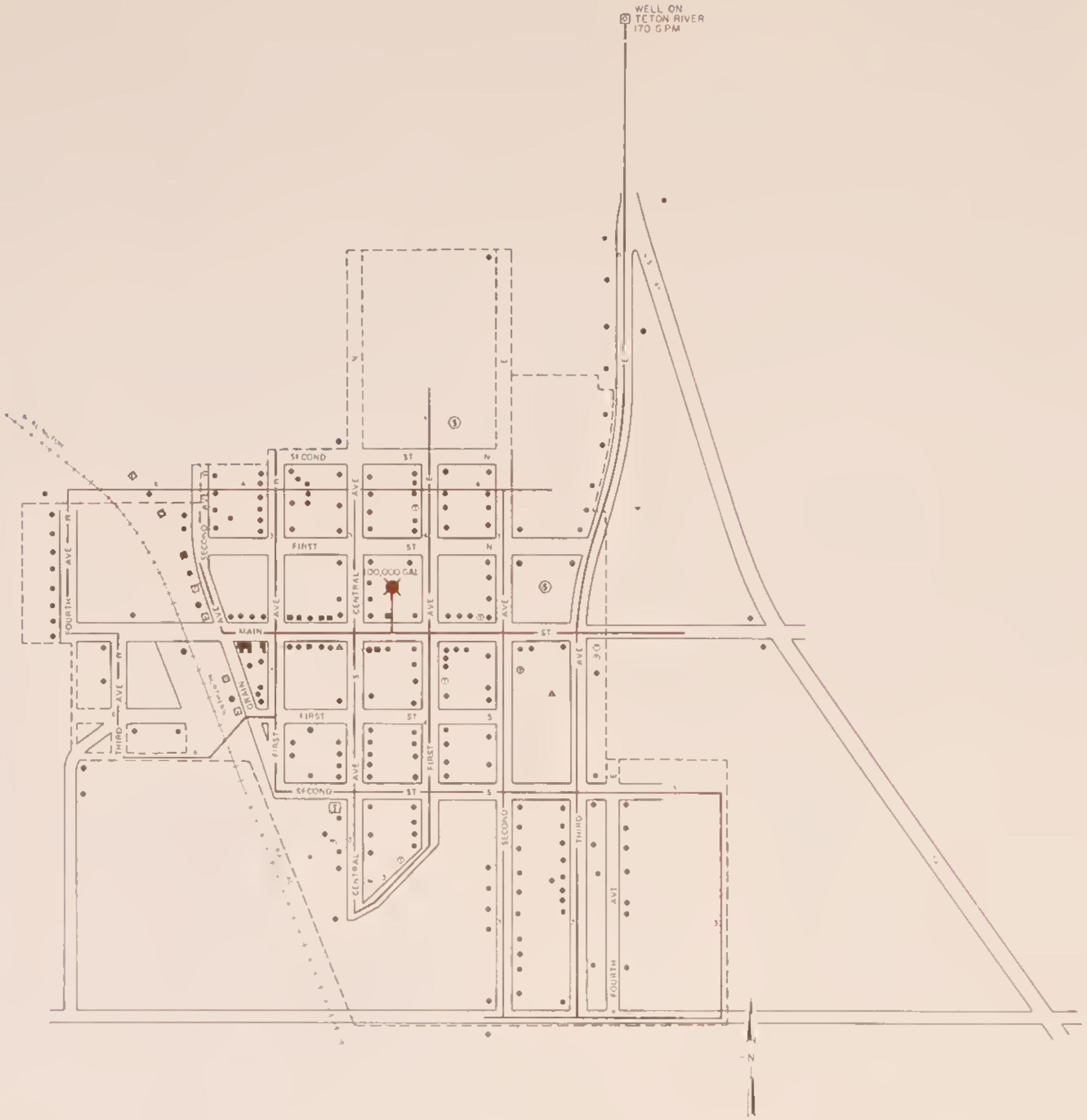
MAP 5



MAP 6

FAIRFIELD
WATER

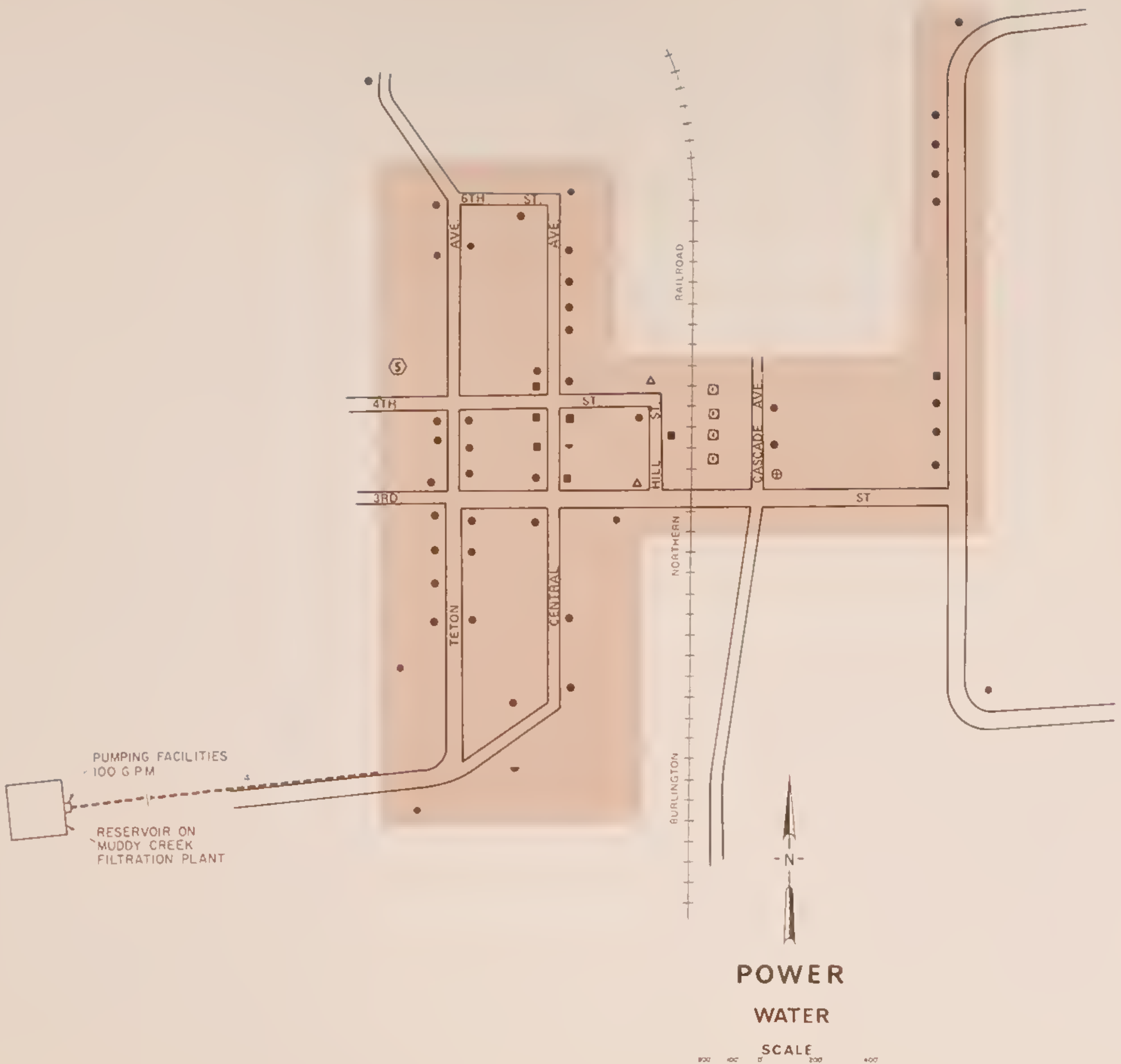
SCALE



DUTTON
WATER

SCALE

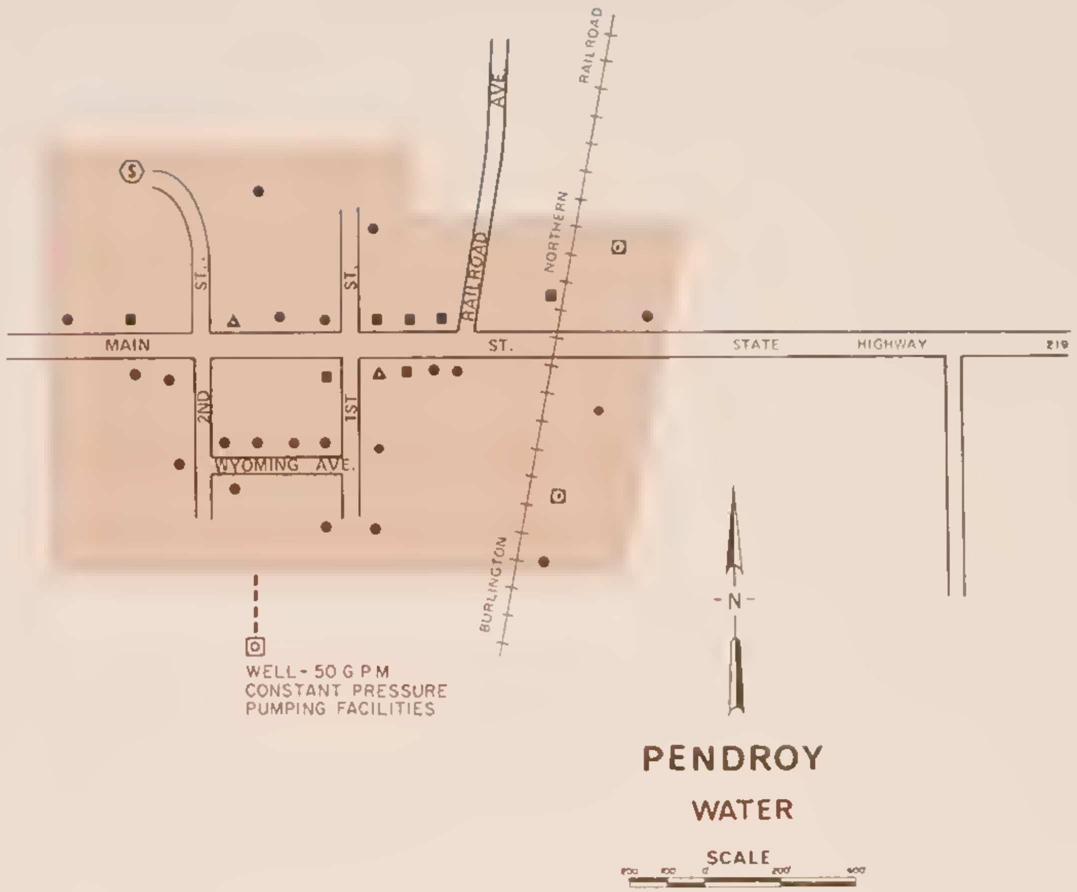
MAP 7


6TH ST.
4TH ST.
3RD ST
AVE
AVE
TETON
CENTRAL
HILL ST.
CASCADE AVE.
BURLINGTON NORTHERN RAILROAD
PUMPING FACILITIES 100 G P M
RESERVOIR ON MUDDY CREEK FILTRATION PLANT
N
SCALE

POWER

WATER

MAP 8


MAIN ST.
STATE HIGHWAY 219
ST.
ST.
2ND
1ST
WYOMING AVE.
RAILROAD AVE.
BURLINGTON NORTHERN RAILROAD
WELL - 50 G P M CONSTANT PRESSURE PUMPING FACILITIES
N
SCALE

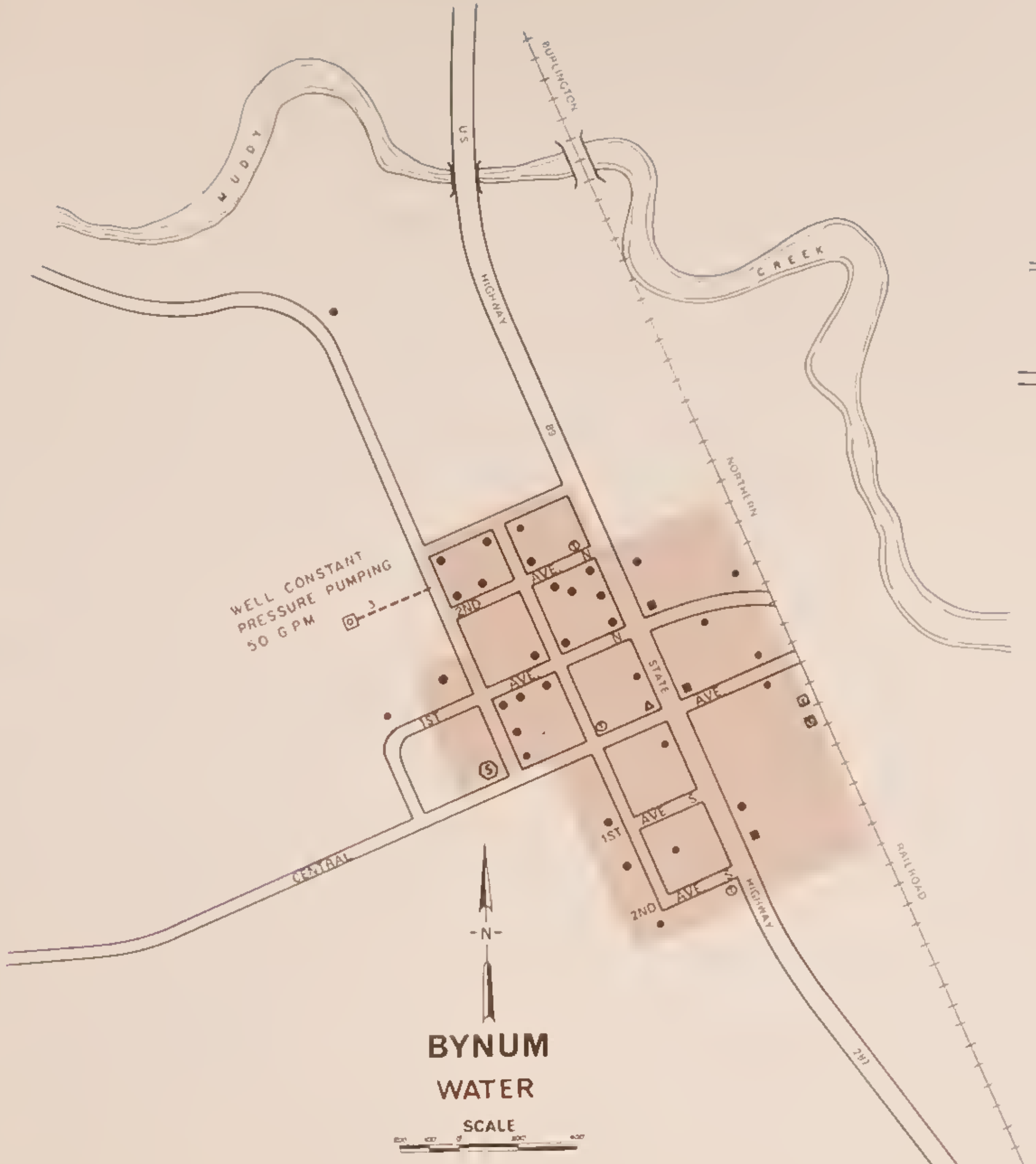
PENDROY

WATER

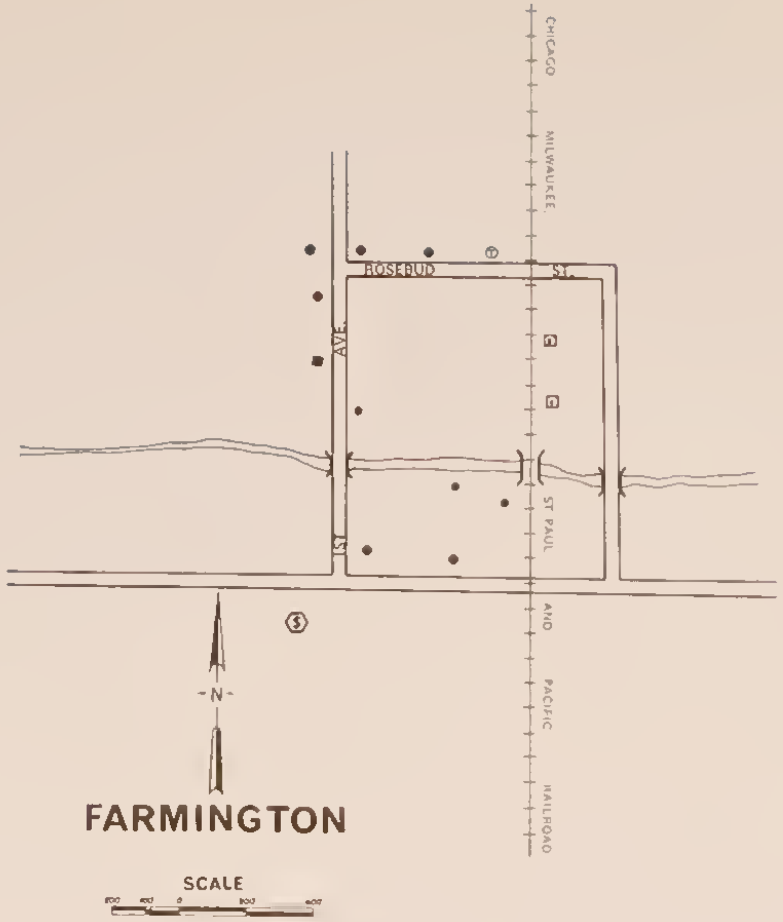
MAP 9

Fold
Out

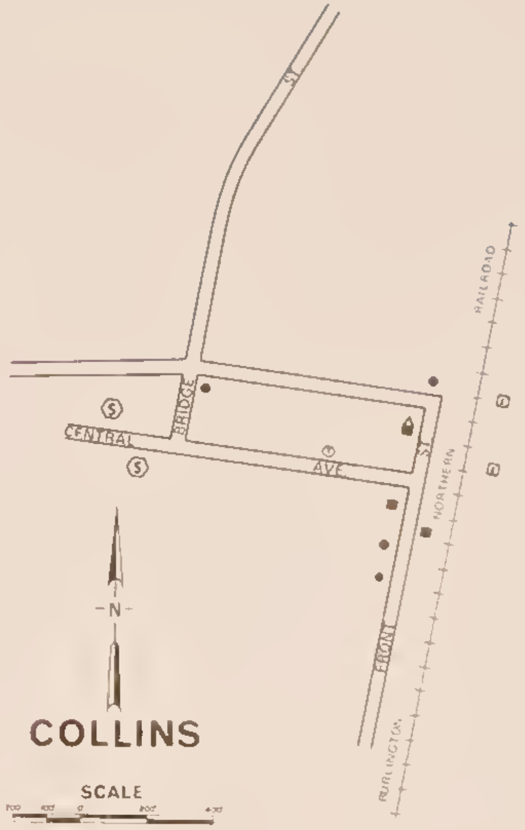
Fold
Out



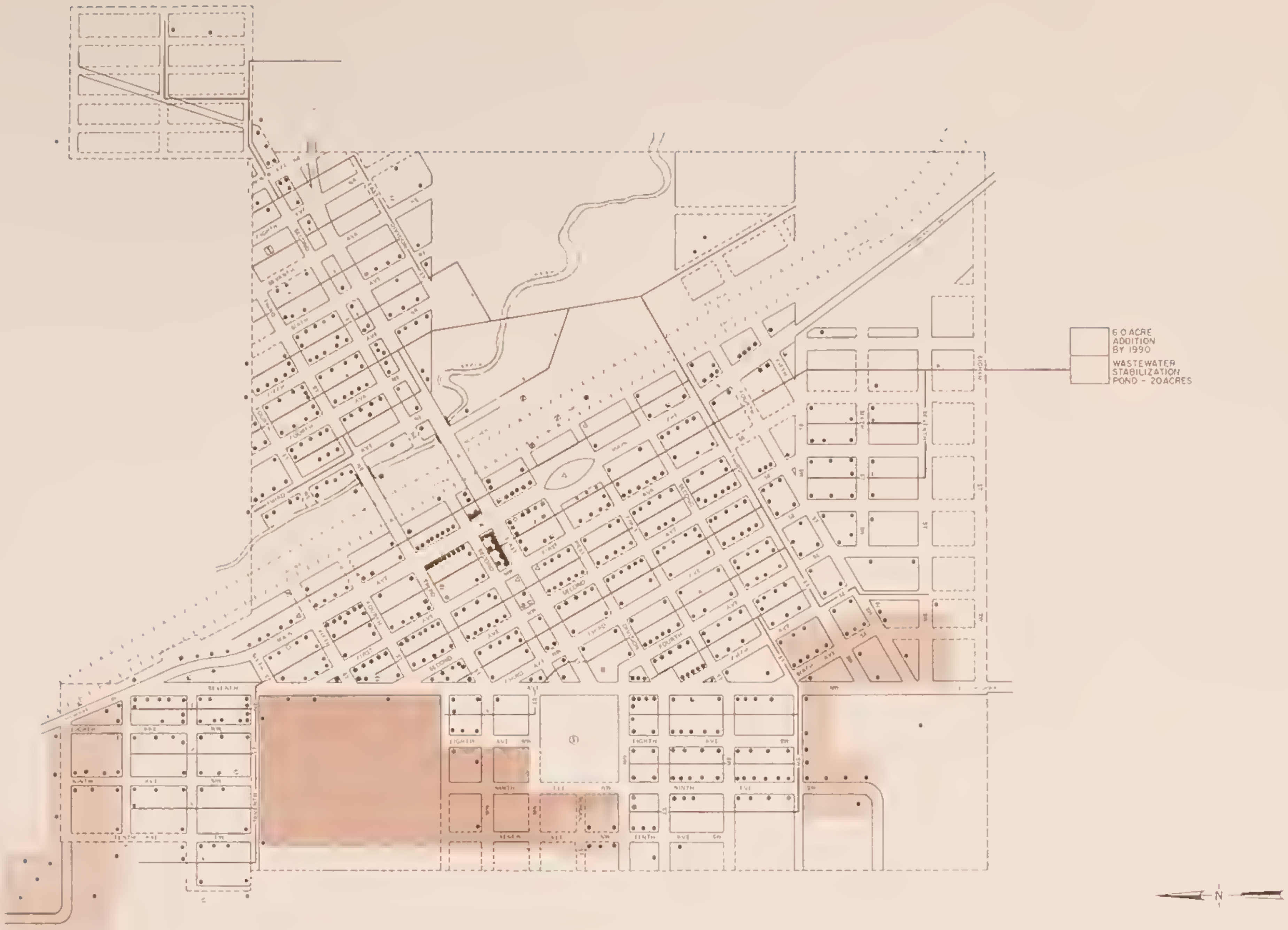
MAP 10



MAP 11



MAP 12

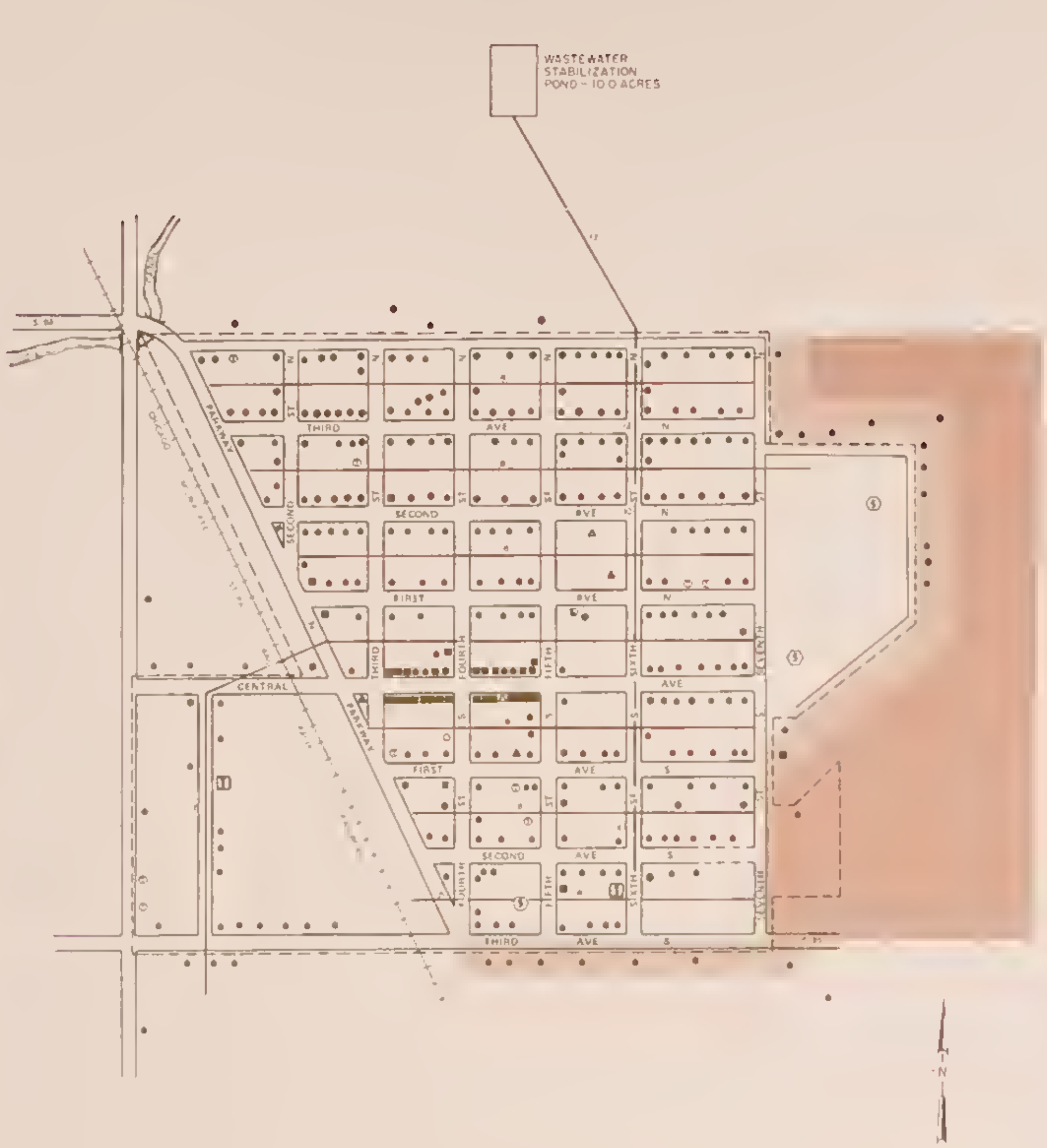

6.0 ACRE ADDITION BY 1990
WASTEWATER STABILIZATION POND - 20 ACRES
N

CHOTEAU

SEWER

SCALE

MAP 13

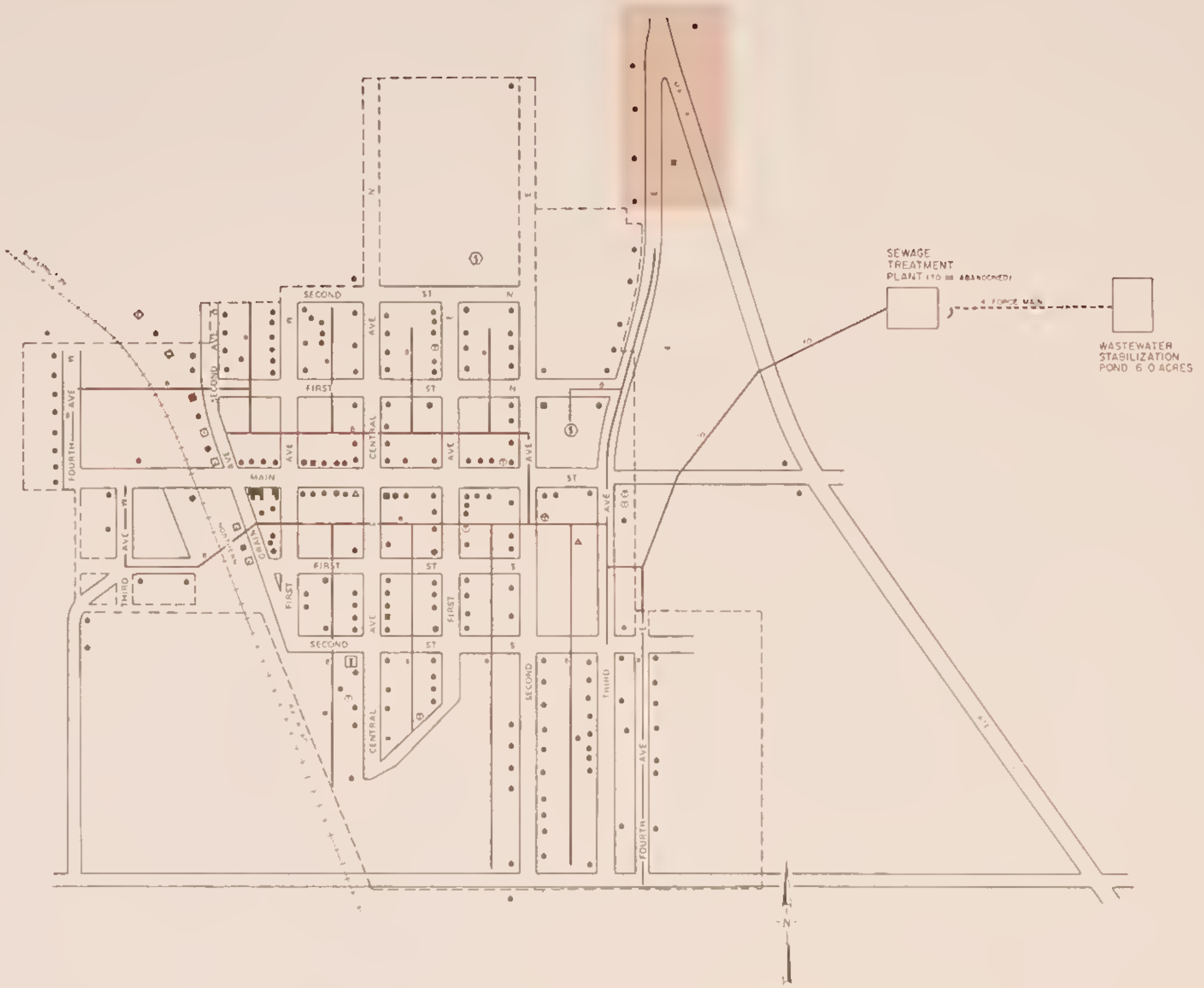


FAIRFIELD

SEWER

SCALE

MAP 14

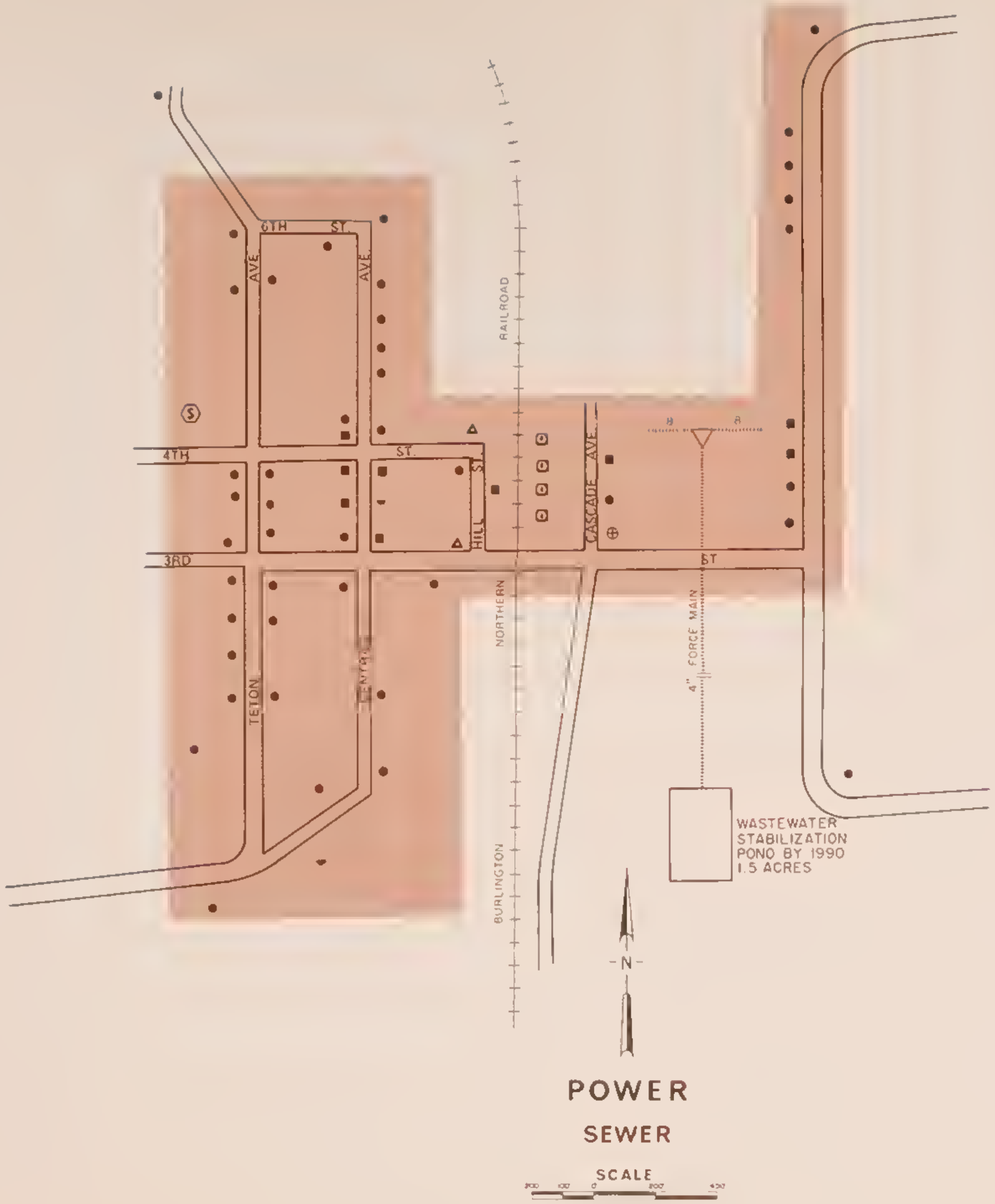


DUTTON

SEWER

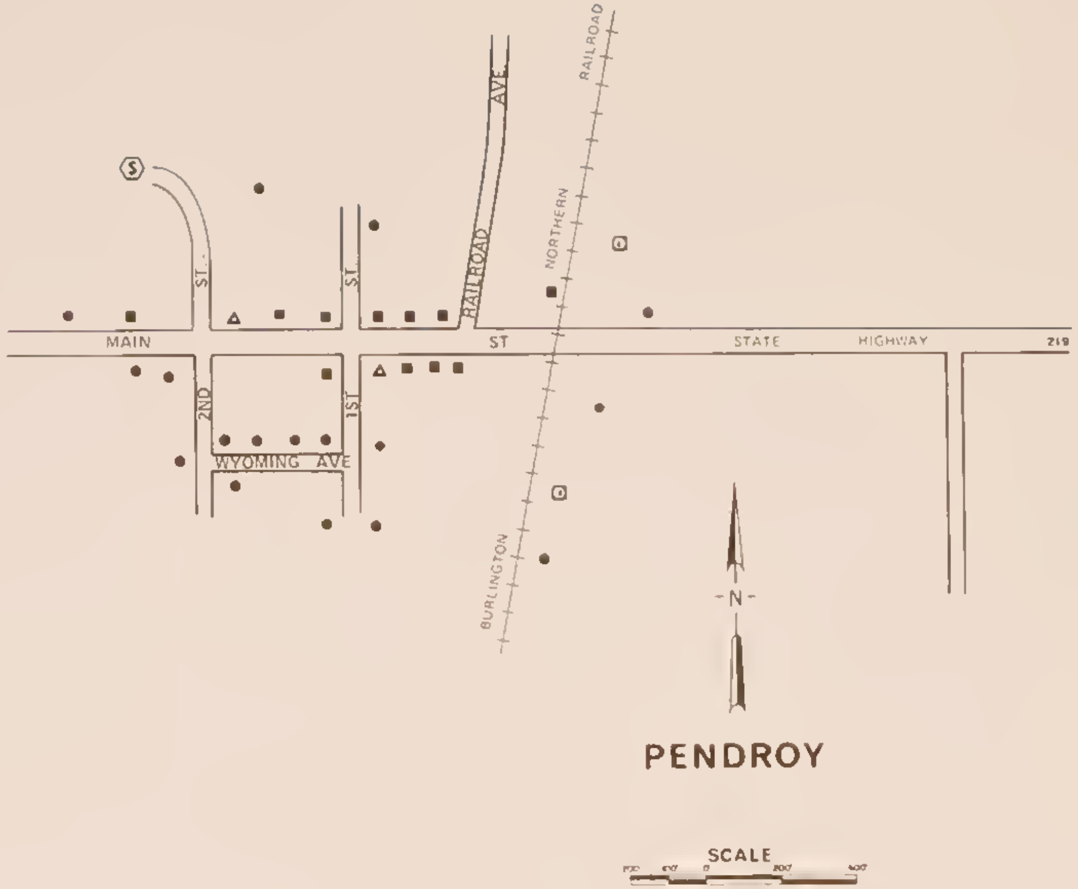
SCALE

MAP 15



POWER

SEWER



PENDROY